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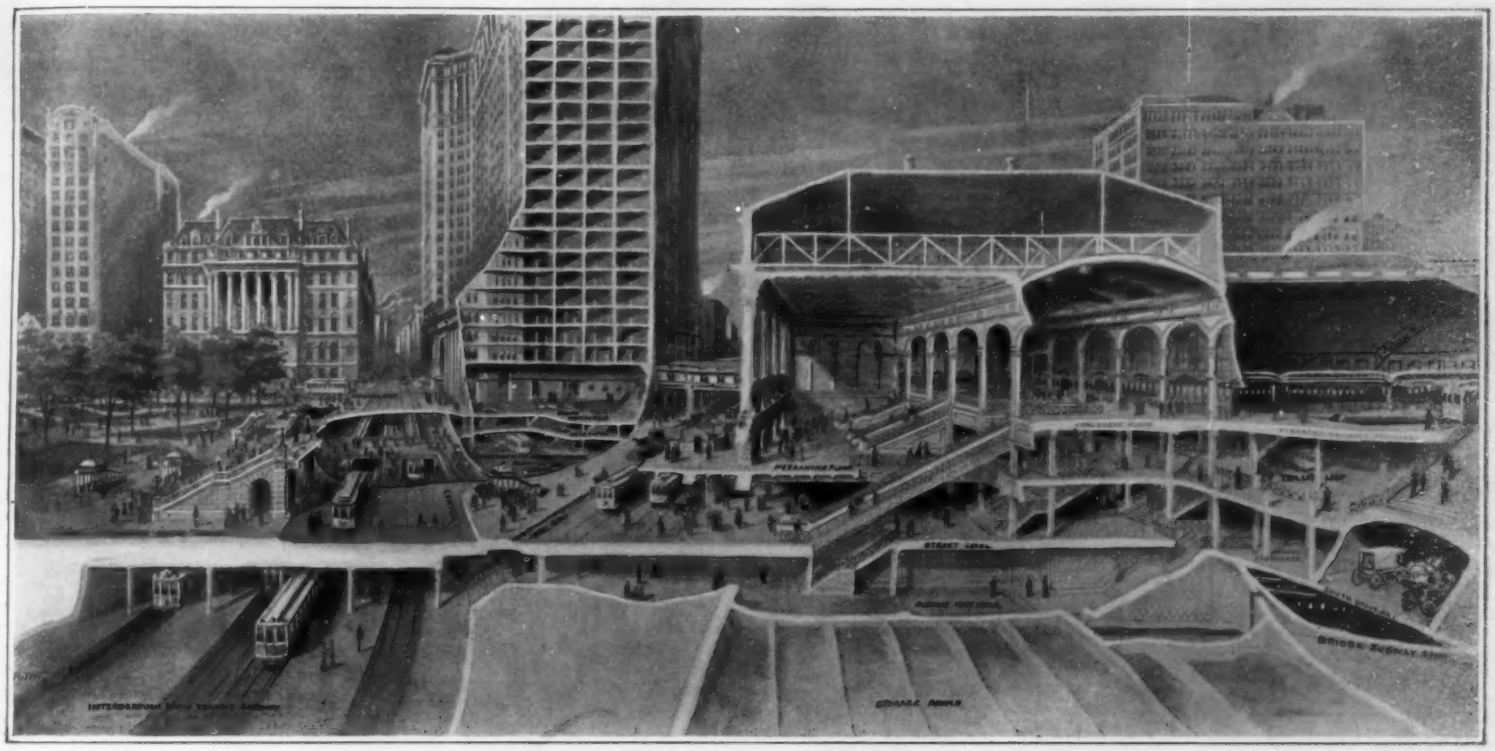

Sectional view, showing the reconstruction of the Brooklyn Bridge Terminal and its connection with the present subway, the new loop subway, and the elevated roads.

Bird's eye view of City Hall Park, showing the Park restored by removal of the Post Office and all structures except the beautiful City Hall. Note the new Brooklyn Bridge Terminal, the Municipal Building, and to the left the proposed new Court House and Post Office.

THE CREATION OF A DIGNIFIED CIVIC CENTER IN NEW YORK.—[See page 195.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Peril of the Steel Rail

THE alarming number of accidents due to broken rails which have occurred during the present winter, and notably the disaster at Manchester on the Lehigh Valley Railroad, have drawn attention once more to the peril of the steel rail. This is not the first time that this subject has been brought to public attention; for many of our readers will remember that, during the winter of 1907, accidents through breaking rails became so frequent that New York State made an official investigation which resulted in disclosing the astounding fact that, during the winter months of that year, 2,899 cases of broken rails had occurred in this State alone!

The SCIENTIFIC AMERICAN made a careful study of the matter. We found that the engineers of the railroad companies laid the blame at the doors of the rail manufacturers, claiming that the latter showed an indisposition to roll rails according to specifications drawn by the engineers—these specifications containing clauses designed to exclude defects and insure that the rails were given that careful treatment in the process of manufacture which is necessary to the production of a thoroughly sound product. The engineers claimed that, in the endeavor to turn out a large product at a minimum cost, the steel men were not only hurrying up the processes of manufacture, but were including in the rail a large amount of the defective material which develops in the head of the ingot castings.

On the other hand, the manufacturers claimed that the breakages were due to the great increase which had taken place in the weight of engines and cars, and that it was impossible to roll rails, even of the heavy 90- and 100-pound sections, which would stand up to their work under the constant and heavy battering to which they were subjected.

Now, in the early days of railroading, broken rails were by no means so frequent in proportion to the traffic as they are to-day. This immunity was due largely to the fact that a softer and tougher steel was used. As traffic developed it was deemed necessary to roll rails of a harder quality of steel, that is, a steel containing a higher percentage of carbon, the object being to prevent the battering down and rapid wear which occurred in the older rails. Hardness, however, is accompanied by brittleness, and so the railroad people have found themselves on the horns of a dilemma. The subject was treated fully in a series of articles which can be found in the SCIENTIFIC AMERICAN of May 18th, 1907. Also, in the current issue of the SUPPLEMENT will be found another article which throws much light on the present state of this question.

In his recent testimony before the Stanley Committee at Washington, President Farrell of the United States Steel Corporation made a statement which is certainly remarkable as coming from such a source. According to press reports, in speaking of the rail which is turned out by his company he said, "The liability to breakage is much greater than in the old-time soft steel, and the influence of the unavoidable contingencies of manufacture, such as seams, pipes and segregations, is much greater. In many respects the steel is more doubtful, more dangerous and more treacherous. It is unquestionably, in my judgment, an unsafe grade of steel in view of the severe conditions of service."

Now, we take decided issue with President Farrell if he is correctly reported as speaking of seams, pipes and segregations, as "unavoidable contingencies of manufacture." They are not unavoidable. Seams and pipes can be eliminated from the rail by cutting off and throwing on to the scrap heap the whole of that portion of the cast ingot into which the pipes extend. For obvious reasons of economy, the steel companies would like to cut off just as little of the ingot as the engineers of the railroad will allow. Nor are segregations unavoidable; care in pouring the ingot, the provision of sufficient time for the contents of the ingot to adjust themselves, and other precautions, all of which mean a certain loss of time, but all of which mean the elimination of defects in the rail, will meet this difficulty.

It is entirely within the resources of modern metallurgy and mill work to produce a high-carbon steel rail that will go through a winter's traffic without endangering the lives of the passengers or the security of the freight.

Opening the East River to the Sound

COL. BLACK of the United States Army Engineer Corps has completed a survey of the Hudson River waterfront and the East River, to determine the feasibility and cost of providing a channel 35 feet in depth from the New York docks on the Hudson River to deep water in the Sound. The survey determined also what would be the best way to reduce the exceedingly heavy and dangerous current which runs through Hell Gate at certain states of the tide.

It is found that for a total sum of $32,000,000 a 35-foot channel, capable of accommodating large ocean-going steamships can be dredged or blasted out which will enable shipping to steam from the docks on the Hudson River past the Battery and through the East River and Hell Gate to the Sound. To reduce the currents in Hell Gate it is proposed to blast out the Harlem Kills and the Little Hell Gate channels to a depth of 24 feet over widths respectively of 480 and 600 feet. The increased cross-section of these two channels, coupled with the deepening of Hell Gate to 35 feet, will reduce the current through the latter channel to a velocity which will not be dangerous to navigation.

Following a public meeting held last week at the City Hall, when Col. Black described the scheme in detail, a strong committee of eighteen representatives of various organizations of the city of New York was appointed, with the chairman of the Harbors and Commerce Committee of the Chamber of Commerce at the head, which will urge upon the federal government the necessity for putting through this great national work.

Now thirty-two million dollars is a great sum of money to spend upon one single work of harbor improvement; but in this, as in every federal work of an engineering character, the question of the magnitude of the outlay is strictly relative. That is to say, the question of its being extravagant or not depends entirely upon the importance of the interests affected and the magnitude of the results of a national and local character which will be achieved.

New York city, by virtue of its geographical position and its unrivaled harbor and port facilities, is to-day, and must forever remain, the chief port of entry and departure for that great stream of traffic, both freight and passenger, which flows in ever-increasing volume to and fro between the old and the new world, and between the great republic of North America and the Latin-American republics in South America. The present era of development of the port of New York is perhaps the most important in its history. Three years from the present date there will be opened three important canals, which will inevitably cause a great increase in the commerce of this port. The Panama Canal, by shortening the distance to points on the Pacific coast of North and South America, and to the great centers of trade in Australasia and the Orient, will cause a growth in our trade with those centers, the magnitude of which it is impossible to foretell. The State Barge Canal will provide vastly improved water communication, not merely with the Great Lakes and the huge territory which is tributary thereto, but also with the flourishing industrial centers which are served by the canal. Cheaper rates will act with their customary stimulating effect in increasing the volume of trade. Lastly, there is another canal, that through Cape Cod, which because of its insignificant length, has never been appreciated at least by the general public at its true value. For the opening of this canal, by providing a sheltered route from New York to Boston, and eliminating the dangerous outside passage around the Cape, to say nothing of the considerable saving of distance, will act most favorably in building up trade between ports on our northern seaboard and the port of New York.

There is a final argument in favor of the opening of the East River, which, perhaps, should be regarded as the strongest of all in favor of federal assistance. We refer to the fact that the greatest navy yard of the United States is situated on the East River, and that by deepening and improving the channel leading to the Sound, this navy yard will be in the unique position of having two deep-water approaches from the sea, the entrances to which are over one hundred miles apart. Consider what this means. In order to blockade New York, an enemy of superior strength would have to separate his fleet into two halves, each of which would have to be powerful enough to meet any fleet of our own which, under the shelter of the guns from coast fortifications, might seek refuge in New York harbor for purposes of repair and refitting. It does not take a naval strategist to appreciate the enormous strategical and tactical advantage conferred on our navy by the possession of a great dock yard from which a powerful fleet can issue to meet the enemy at either of two points over one hundred miles apart.

The New York Motor Boat Show

FOR the last show which will probably be held in Madison Square Garden the National Association of Engine and Boat Manufacturers devoted its attention chiefly to the decorative scheme, which was this year more elaborate than ever before. Each side of the exhibition building was hung with canvas painted to represent the side of a huge ocean liner, the deck of the liner being filled with the stalls and booths of the parts manufacturers, which occupied the elevated platform. At the east end of the Garden was a canvas painted to represent the Hudson River with a scout cruiser and a fast motor boat racing in the foreground.

While there were a half dozen expensively-equipped gasoline yachts and cruisers, the display of small boats was not quite as large as heretofore, and the same was true of the exhibition of engines. The various engine manufacturers confined themselves to two or three well-finished models, as a rule, though a few had a complete line of their product on exhibition. One of the best finished engines at the show was a huge 12-cylinder motor elaborately finished in blue enamel. This engine, which develops some 200 horse-power, is one of a pair to be installed in a new hydroplane ("Disturber III"). There were several other large 6-cylinder engines exhibited, most of these being of the marine type with open cranks, such as have been exhibited in former years and are well known to our readers. There were also a few large 6-cylinder motors with inclosed cranks, one make in particular being capable of developing 200 horse-power at 1,000 revolutions per minute for a weight of 2,200 pounds. In comparison with this, the 150-horse-power at 550 revolutions per minute, American-built Diesel engine shown, with a weight of 5 tons, is a monster.

Most of the smaller engines were of the 2-cycle type, as heretofore; but the 2-cycle motor was shown this year with improvements such as a cylindrical rotary valve that has been used during the past season with success on a well-known 4-cylinder, 2-cycle, aeronautic motor built by a pioneer American maker. This light weight motor, which develops 50 horse-power for 170 pounds net weight, was exhibited, as well as another similar aeronautical motor which has adopted the rotary valve and the maker of which claims to have produced a motor that can be run continuously for ten hours at a stretch, while developing 60 brake-horse-power with a weight of 210 pounds. Probably the most novel motor in the show was a 6-cylinder, V-type, 2-cycle motor of 268 pounds net weight and 75 horse-power capacity at 1,000 revolutions per minute. The total weight of this motor with accessories is 375 pounds. An 8-cylinder, V-type, 60-horse-power 4-cycle motor with copper water jackets was also exhibited.

There were a number of small single-step hydroplanes on exhibition this year. Most of these were equipped with fairly powerful engines and are said to be capable of making speeds of 35 miles an hour or more. As for the displacement boats, a commodious family launch can be had for $1,000, and smaller boats, of steel or wood, the former type being non-sinkable, can be obtained for considerably less. There have been no startling changes in either hulls or engines during the past year, but the motor boat industry continues to thrive by [illegible] ing standard craft.

Engineering

Valuable Scrap at Panama.—The disposal of scrap iron and useless machinery which passed into the possession of the United States on the sale of the canal by the French company has netted the surprising sum of $2,112,000. In spite of the fact that a considerable amount of the French plant has been overhauled and put in service, nearly 30,000 tons of metal scrap has been shipped to the United States from the Isthmus.

British and French High-speed Trains.—The fastest trains in the world are to be found in England and France. In England there are eight regular daily trains with speeds from 55.1 to 59.2 miles per hour whose stop-to-stop runs are from 72 to 118⅝ miles in length. The French roads run four daily trains over a distance of 77¾ to 107½ miles at speeds of from 56.2 to 61.8 miles per hour.

Canadian Forest Conservation.—The Forestry Branch of the Department of the Interior is studying the question of raising profitable crops of timber on waste lands or "wood lots" in Canada. There is said to be 16,000,000 acres of Dominion forest reserves in Canada, to say nothing of areas of non-agricultural land suitable for forest cultivation. The Forestry Branch has sent one of its staff to study the system of forest management followed by the United States Forest Service in the national forest of Montana.

Railway Terminal Snow Melters.—At various points outside the trainshed of the Chicago and Northwestern new passenger station at Chicago, snow melters have been provided which are doing good work. They consist of steel pans with semicircular bottoms, and containing perforated steam coils. They are set in the track floor flush with the tops of the ties, and the melted snow is carried off to the sewers by drain pipes leading from the pans. Snow is shoveled to the pans and there melted.

Growth of the Aluminium Industry.—Although the early expectations of the wholesale substitution of aluminium for steel and iron have not, for very good reasons, materialized, it has shown such a perfect adaptability to certain of the arts that the demand for the new alloy has grown enormously. From a production in the United States of less than 100,000 pounds in 1883, in 1893 the output had grown to 350,000 pounds, in 1903 to 7,500,000 pounds and to-day it is in excess of 50,000,000 pounds.

Twenty-eight Thousand Ton Warships for Chili.—The navies of the South American republics may not be large, but the individual units, at least of the newer ships, are very powerful. Two battleships now being built in England for Chili will be 28,000 tons in displacement and of 23 knots speed. They will carry ten 14-inch guns in turrets and four 21-inch torpedo tubes; and they will have a normal coal supply of 3,500 tons with 450 tons of oil fuel. Their length of 625 feet will render them the longest battleships in existence.

A Gasoline Street Car Experiment.—An experiment in the propulsion of street cars by the gasoline engine, which should afford valuable data for comparison with the cost of electric operation, is being made on a stretch of line in England. The experimental car with a capacity of thirty-seven passengers, is driven by a 55-horse-power gasoline engine. In a comparison of cost, the gasoline car has the advantage that there are no fixed charges for the overhead or underground equipment for transmission of the power. The economy of a good gasoline engine should compare favorably with that of a central steam electric plant.

Nickel Steel in German Bridges.—We are familiar in America with the use of nickel steel for certain portions of our large bridges. A notable instance of this was the construction of the stiffening trusses for the recently completed Manhattan suspension bridge across the East River, New York. The first use of this alloy in Germany was made when a few special parts of the new Harburg bridge over the Elbe were made of this metal. Other cases were the main trusses of a bridge on the Oberhausen-Dorsten Railroad built in 1910; the stiffening truss of a 387-foot suspension bridge at Kiel; and a 200-foot double-track bridge over the Rhine-Herne canal. The alloy contains from 2 to 2½ per cent of nickel.

Endurance of a Diesel Engine.—The British firm which is building two sets of eight-cylinder, four-cycle Diesel engines, of 2,500 combined horse-power for the "Jutlandia," have recently tested a single-cylinder model, which corresponds in every particular with the cylinders which make up each eight-cylinder group. According to the *Engineer*, this "trial" engine, whose cylinder is 22 inches in diameter by 29¼ stroke, completed a thirty-day continuous night-and-day, non-stop run, 28 days of which were at full power. We quite agree with our contemporary that "such a run as this should go far to convince the superintending engineer that the Diesel engine has now reached a stage of progress at which it calls for at least his most serious consideration."

Science

The Royal Society.—The two hundred and fiftieth anniversary of the foundation of the Royal Society (London) will be celebrated with appropriate ceremonies July 16th to 18th, 1912.

Petroleum Fields in Turkestan.—Petroleum fields covering a vast area of Turkestan extending to the Chinese frontier and the Pamirs have recently been surveyed by Prof. Hjalmar Sjögren, of Stockholm. Although the new fields are not expected to revolutionize the petroleum market, they will help to supply the rapidly increasing demand for petroleum in China, and to some extent will probably benefit consumers in other parts of the world.

The Australian Antarctic Expedition.—This expedition, regarding which we have already published several notes, finally sailed from Hobart, Tasmania, on the 2nd of last December, and after a rough passage of over a fortnight reached Macquarie Island, thus accomplishing about half its journey to Antarctica. Especially noteworthy is the fact that the arrival of the party at this point was reported by wireless from the vessel (the "Aurora").

Wild Volatile Oil Plants and Their Economic Importance.—The Bureau of Plant Industry of the United States Department of Agriculture has just issued a monograph by Frank Rabak in which it is shown that the volatile oil distilled from black sage, wild sage and swamp bay represent but a small part of our wild aromatic flora, and yet these three plants gathered from their wild haunts have no little economic importance. These three plants, representing specimens taken up at random, have been shown to yield oil containing large quantities of camphor, borneol and cineol.

A Monument to Two Great African Explorers.—Funds are being raised in Great Britain for the purpose of erecting a striking monument to Mungo Park and Richard Lander, who accomplished epoch-making journeys in West Africa; the former about the beginning of the nineteenth century; the latter thirty years later. As the main object of their travels was to discover where the Niger joined the ocean, the site chosen for their monument is Forcados, at the Niger mouth. It is proposed to erect an obelisk of similar design and dimensions to Cleopatra's Needle, on a projecting point where it will both attract general attention and serve as a landmark to vessels approaching the port. The cost is estimated at £2,000, exclusive of the foundations, which it is expected will be erected by the government of Southern Nigeria.

Photometric Observations of Planetoids.—One of the most important problems in astronomical photometry is the determination of the light of the planetoids. The problem is a very complicated one, since the light varies not only with the distance from the sun and earth, but also with the phase angle, according to a curious law. Several observers have shown that this variation is proportional to the phase angle, a law for which no physical explanation has been offered. In addition, Eros and some other planetoids have been found to vary in a period of several hours. These changes are very puzzling, since they sometimes cease, or the range alters, without obvious cause. A recent circular issued by Harvard College Observatory states that photometry of the planetoids in the future will be studied mainly by photography, as soon as a satisfactory scale of photographic magnitudes can be established for all the stars. At present, several series of photometric measures have been made visually, the results of which are given in the circular. Photometric observations of planetoids are compiled from various sources.

"Loans on Honor."—A novel form of charity, recently inaugurated at Lyons, France, is described in a report from the American consul at that place. A society called the "Loan of Honor" has been established by a number of philanthropists for the purpose of lending small sums of money without security to needy persons. The applicant for a loan has to fill up a question blank, the information thus obtained enabling the society to judge whether the case is worthy of relief. If so, the borrower is required to give his or her word of honor to return the amount of the loan within a certain time. During the last fiscal year 384 persons were thus aided, comprising clerks, small trades people, teachers, millhands, mechanics, etc., and 68 women occupying humble positions. Some of the causes for the applications were stated to be: Sickness, 119 cases; lack of work, 83 cases; debts, 84 cases; starting housekeeping, 27 cases. All but 27 of those granted loans were married people. A very small fraction of the total amount lent up to date has not been returned at the expiration of the specified period of the loan. The consul's report does not state whether interest is charged on the loans, but leads us to infer that it is not.

Aeronautics

More Attempts to Fly Across the Isthmus of Panama.—The latest aspirant to the honor of first crossing the Isthmus of Panama in an aeroplane is Clarence De Geirs, a young mining engineer of New York city who obtained his license from the Moisant school last December. Mr. DeGeirs expects to make the attempt with a Moisant monoplane equipped with a 50 horse-power Gnome motor. Jesse Seligman had previously intended to make the flight in a Moisant machine, but was obliged to give it up on account of an accident he met with in Costa Rica.

A New Passenger-carrying Record.—On January 27th, the day that Bathiat broke the speed record with a Sommer monoplane as recorded in our last issue, Molla, on a Sommer biplane, made a new world's record by flying one hour with six passengers. He carried 65 liters of gasoline and 30 liters of oil in addition to the live load, the total weight of which, including himself, was about 1,000 pounds. Two days previously, at Johannistal, Germany, Grulich, on his Harlan monoplane, carried three passengers for an hour and thirty-five minutes and beat Warchalowsky's record of 45 minutes and 40 seconds made some time ago in Austria.

First Flight Across the Great Lakes.—On February 20th, Earl Sandt, a young biplane pilot, flew from Erie, Pennsylvania, 40 miles across the lake to Port Rowan, Canada. He had a mishap during his return trip while ten miles out above Lake Erie from Northeast, Pa., and fell on the ice. His machine was wrecked and he lay unconscious for several hours. He finally regained consciousness and managed to walk to shore guided by a pocket compass. He did not reach Northeast until 10 P. M. He was finally discovered by some skaters and was rescued. That he escaped with his life after his perilous trip is well nigh miraculous.

Chief Claim of Wright Patent Invalidated in [Germany.—On Washington's Birthday the German Patent Office declared invalid the basic feature of the Wright patent, viz., the claim of the simultaneous warping of the wings and turning of the vertical rudder. Two specific combinations of warping and steering were allowed, but the broad claim was declared invalid. This decision in the suit brought against the Wright company by five German firms is subject to appeal before the Imperial Supreme Court at Leipzig, but as the decisions of the German Patent Office generally bear great weight, this one, if held, will prove a hard blow to the Wright patents in all countries.

Vedrines Shatters Speed Records.—Jules Vedrines, on Washington's Birthday, regained the 100 and 200-kilometer speed record with his 100-horse-power Deperdussin monoplane. He covered the former distance—62.1 miles—in 37 minutes and 58 seconds, equal to 98.13 miles per hour, while the 1¼ hours scored by him for the second distance—124.2 miles—gave him an average of 99.36 miles per hour for the total. As his average was less for the first half of the flight, he must have done better than 100 miles an hour at times in order to make the high average he did for the total. As this tremendous speed has been maintained already for the full distance of the international races to be held at Chicago next summer, better than 100 miles an hour will doubtless be made in that event, and France will probably take the cup.

Record Flights Near New York.—While Frank Coffyn has been flying almost daily above New York harbor in his Wright hydro-aeroplane, and has taken many moving pictures himself from the machine, George W. Beatty has been industriously training pupils at Nassau Boulevard. On the 13th ultimo Beatty made a flight to New York and landed upon the North Meadow of Central Park. After leaving his machine there over night he flew back the next morning in about twenty minutes. This is the first time that an aviator has flown over Central Park and landed in it. Both flights were made without any trouble and the usefulness of proper landing places in the parks for aviators was demonstrated. It is to be hoped that the recent discussion about "Isles of Safety" for aviators will cause the setting apart of suitable landing places.

More Aeroplane Accidents.—On February 3rd, Capt. LeMagnet fell 200 feet or more in France and sustained injuries from which he died several days later. On the 16th a German aviator named Schmidt fell and was killed as a result of the breaking of the connection to his horizontal rudder. On the 17th ultimo D. Graham Gilmour, a well-known British aviator, was instantly killed by a fall when the wings of his monoplane buckled and the machine dropped to the ground from a height of about 400 feet. Gilmour was testing a new monoplane of small size and was traveling sixty miles an hour from Brooklands to Richmond when the accident happened. This type of accident is fortunately a rare one. The chief occurrences of a similar kind happened in France about a year ago when MM. Laffont and Pola were dashed to death by the breaking of the wings of the Antoinette monoplane.

A glimpse of the gathering vats.

Making prints and rolls.

Making Oleomargarine Respectable

How the Fat of Cattle and Hogs is Converted into a Butter Substitute

By William Atherton Du Puy

BOTH the legislative and the executive branches of the Government have been, for two years past, laboring industriously to find out just what a certain food product, oleomargarine by name, is composed of and what is its position in that galaxy of respectable foodstuffs which come regularly to the tables of all the people. A heightened interest in this search, after the truth has been occasioned by the tendency of butter to climb to prices the height of which have never before been equalled. After exhaustive investigations by various agencies of the government a conclusion has been reached and Congress is just now in the act of putting through legislation that will have the effect of stabilizing the oleomargarine industry and putting it upon the basis of its own merit.

The first agency of the Government that has been strongly interested in oleomargarine is the Internal Revenue Bureau. This bureau has had charge of the work of enforcing a tax upon this product. In order that the tax might be enforced it has been necessary that the agents of the Internal Revenue Bureau follow oleomargarine carefully from the factory to the consumer. In doing this the agents of this bureau have learned a great deal about oleomargarine. In the first place they have learned what are the materials that go to make up this product as it is found on the market. The Internal Revenue Bureau has taken a great number of tested samples and has struck an average upon them, and this average may be taken as the typical oleomargarine of this country.

The material which appears in the largest percentages is the so-called oleo oil. This oleo oil is a product of the packing house and is secured by refining the fats of animals, principally cattle, but also to a large extent hogs. The fats used in this connection are largely the purer inside fats. Of this oleo oil the average package of oleomargarine contains 34.29 per cent. The next ingredient in importance because of the percentage of its presence is milk. Milk finds its way into oleomargarine in the process of its manufacture. Oleomargarine is churned in milk in order that it may acquire the peculiar constituency of butter. Butter is put together in a peculiar way. It consists of a very large number of tiny globules of fat. These globules are inclosed in minute sacks. It gets into this peculiar condition in the process of churning. It is because of this physical arrangement of globules that butter is so well adapted to the purpose of spreading on bread.

An oleomargarine churn.

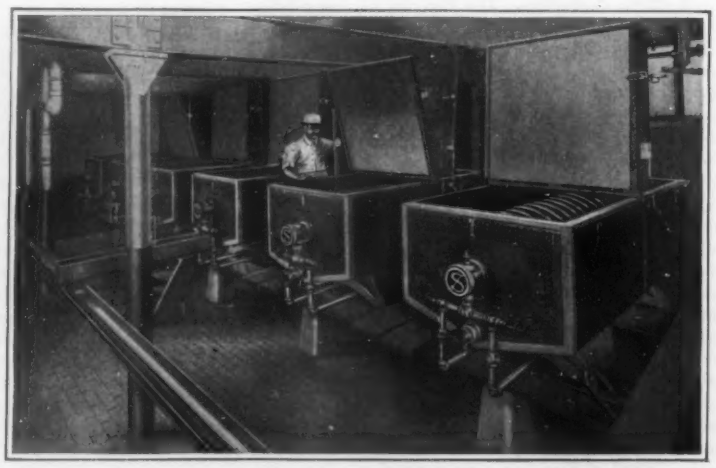
When the various oils that go into the manufacture of oleomargarine are put into the great churns of one of the factories that turn out this product those fats are so shaken about and admixed with the milk that they acquire this same physical arrangement of globules that is peculiar to butter. There is the little sack of fat with the enclosing walls. These walls in oleomargarine globules are somewhat thicker than in the case of butter. This gives oleomargarine a slightly higher percentage of the material that goes into sack making than has butter and a slightly lower percentage of fats. This percentage is in the proportion of 100 to 102, these being the relative food values of butter and oleomargarine.

In this churning process the oleo oils take up 20.09 per cent of the milk constituents. The next largest constituent of oleomargarine is what is known as neutral. This is also an animal fat very similar to the so-called oleo oils. Of this neutral 16.27 per cent enters the average package of oleomargarine. Next to this in importance is cotton seed oil, which finds its way into this food product to the amount of 14.36 per cent. Salt appears to the extent of 7.33, cream 3.09 per cent, and butter to the extent of 2.98 per cent. There are small traces of *stearin*, peanut oil, and sesame oil, these latter being merely incidental as are traces of glucose and eggs.

So has the Internal Revenue Office determined just what is the constituency of oleomargarine. Another Government bureau that has much to do with this product is the meat inspection division of the Bureau

(*Continued on page 205.*)

Machine for working oleomargarine.



A battery of cream ripeners.

THE MANUFACTURE OF OLEOMARGARINE

Welfare Work in Germany—IV

Housing, Feeding, Amusing, and Pensioning Workingmen on Business Principles

By Waldemar B. Kaempffert

[This is the fourth of the series of articles by the Managing Editor of the SCIENTIFIC AMERICAN *on German industrial conditions. The author was sent to Europe by the publishers of the* SCIENTIFIC AMERICAN *for the express purpose of gathering the information on which this series of articles is based.]*

IF you, as a manufacturer, are compelled by law to pay insurance premiums on the life, health, and physical condition of your employees; if, furthermore, you are required to safeguard all dangerous machinery, to provide large and airy work rooms, you would probably feel that your bank account had been reduced by just so much, and that it was hardly necessary for you to devote much more attention to the welfare of those whom you employ. Not so in Germany. It pays in cash, so the German has found, to outdo the Government in caring for the workingman.

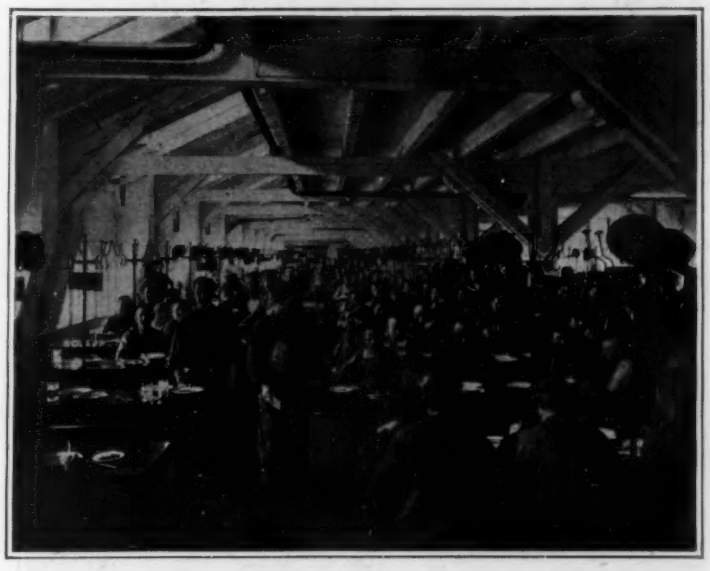
Fuel for the Human Machine.

A mechanic works better in good surroundings than in bad. The factory laws in Germany outline a minimum of goodness. The German employer makes no attempt to attain a maximum, but something considerably above that minimum. He sees to it that his factory is a brighter, cleaner, roomier, safer place than the factory laws stipulate that it shall be. If a man works better in good surroundings, he also works better if he is fed well. It pays to shovel good coal under a boiler. Why should it not pay to give a man good food? After all, a man is a machine, and food, like coal, contains so many heat units. If it pays to use coal containing the maximum number of heat units in order to get the maximum effect out of a steam engine, why should it not pay equally well to supply food-fuel also containing the greatest possible number of heat units and get out of the human machine the maximum effect in mental and physical work? So we find that the big German employer buys food for his men as he buys his coal—on strictly scientific principles. He does not give the food away, but he sells it far below its cost. Increased efficiency more than compensates him for the loss. At Elberfeld the men of the great chemical works can buy a meal at a price that varies from ten cents to seventeen cents and that in no case exceeds a weekly total of ninety cents. The Badische Company, at Ludwigshafen, sells one-third of a pound of beef or pork and one quart of soup and vegetables for five cents, the actual cost to the firm being ten cents. Coffee, with milk and sugar, is supplied for half a cent.

Apparently it is not enough to supply men and women with good cheap food. They must be able to eat it in comfort. Special dining halls and canteens have been erected for that purpose, which are also places of recreation, for they are open not only at meal time, but also before and after hours. Even the workingmen who prefer home cooking, whose meals are brought to them by their wives or their children, are provided for. The Badische Company, for example, has erected for their use a special dining hall outside of the factory, surrounded by a garden and shade trees, a dining-room which is big enough for 240 persons, and in which the men can sit with their wives and children during meals.

The effects of factory conditions upon health have also been studied. In huge chemical works steam apparatus must be employed both summer and winter. When the thermometer drops below 60 no inconvenience is felt; but in summer time there is a demand for cold water. In most American plants the ice water keg is emptied several times, on a hot day, not to the benefit of the workingman's health. An unhealthy employee is a piece of apparatus of reduced efficiency. Hence the Badische Company supplies coffee during working hours to the amount of 50,000 gallons a year.

A typical apprentice school of the kind maintained by German machinery builders.



Workingmen's dining hall of the Siemens-Schuckert works.

Modern tenement houses of the Krupp workingmen's colony.

Housing Systems.

The proper housing of employees gives the German manufacturer fully as much concern as the sanitary conditions of the work room. If he does not actually build the workingman's house for him he will either lend building money on very liberal terms or refer the workingman to a loan association.

German ideas in workingmen's colonies have changed vastly in the last twenty years. The early attempts resulted in unattractive communities not unlike the dull monotony of Pullman and Gary in this country. It seems as if the manufacturer had said to a contractor: "I have so many workingmen to house and so many acres at my disposal. Build me dwellings, costing so and so much, to the number of so and so many." One set of architect's plans served for forty houses.

Alfred Krupp was one of the first who departed from this simple plan; yet even his original colony is stilted in aspect. His successors have so far improved on his conception that the cottages and tenements of Essen, where 40,000 men are employed in the cast steel works alone, may well be regarded as a model in every way.

The Krupp ideas have been changed by the very force of circumstances. In the early days, when land was cheap in Essen, individual cottages could be built. Nowadays that is impossible. Such is the value of real estate that tenements must be constructed—tenements, however, so planned that to the uninformed visitor they seem more like the apartment houses of a prosperous middle-class community.

We Americans have been accustomed to regard Gary as a unique example of a town built to order around a great steel plant. A counterpart of that performance, but far more artistic, may be found at Leverkusen, opposite the city of Cologne. To Leverkusen the great coal-tar dye works of Elberfeld have transferred their activities; but at Leverkusen, it so happened, there were no accommodations for workingmen. The creation of these accommodations was carried out in a way that would hardly be expected of a manufacturer. Houses were designed and built that bear comparison with the best suburban villas in this country. What is more, amusement places were established, for at Leverkusen there was no theater, no lecture hall, no place for recreation.

So, too, the great chemical factories that cluster around Frankfort (the Griesheim-Elektron works, the Leopold Cassella plant, and the Hoechst plant) all have their workingmen's colonies, built at enormous expense. One colony alone consisting of 550 dwellings for 3,000 workingmen was established by the Badische Company at a cost of $700,000. The weekly rental of the smallest type of dwelling is the mere pittance of one mark and eighty pfennigs, equivalent to nearly forty-three cents in American money.

Workingmen at Play.

Germany is the land of *Gemuetlichkeit*, a term for which there is no exact English equivalent. *Gemuetlichkeit* is the result partly of cheerful surroundings, partly of cheerful company, without any trace of formality. It plays so large a part in German life that an employer of labor has to consider it. Hence it is that manufacturers encourage the formation of workingmen's clubs and societies and contribute liberally to their support. There is, of

course, the inevitable German singing society, and the inevitable German band, supplemented sometimes by a string orchestra, all maintained partly by the workingmen, partly by their employers. Amateur theatricals, visits to museums, recreation of an educational character are everywhere to be found. If a Madam Curie discovers radium, forthwith a lecturer is engaged and holds forth in popular language before the various factory clubs and organizations on the new discovery. If a Richard Straus composes a "Salome," the musical critic of the local newspaper is asked to point out the beauties of the new super-Wagnerian music. If a Mona Lisa is stolen, there is bound to be a lecture on Leonardo. If a war breaks out in Tripoli, the moving picture transports the men and women of Leverkusen, or wherever it may be, to Africa and shows them Turks and Italians preparing for conflict.

Schools, too, there are—schools to educate the sons and daughters of employees, schools where children of workingmen learn wood carving, weaving and handicrafts, schools where housekeeping and needlework are taught, maintained partly by the workingmen, without compulsion, and partly by the employers.

Insurance and Pension Systems.

In the last article of this series the State system of workingmen's insurance was sketched. Big German corporations have established in addition, private insurance systems of their own for the benefit of their employees. As a body they spend millions on these supplemental insurance schemes. How much more they do than the government actually requires is illustrated by the case of the Elberfeld works, to mention a solitary example. In 1910 that firm paid out $65,261.22 in accordance with the insurance laws, but the voluntary contributions of the firm to its own insurance fund amount to $443,246, more than seven times more than the State required.

Almost every self respecting German manufacturer who employs several hundred men maintains a pension system of his own regardless of what the government may dictate. Among the larger chemical works, for example, invalid workingmen who have been in the employ of the firm for more than five years or men who have been with the company for thirty years are entitled to a pension. To be sure the workingmen pay in to the insurance and pension fund a certain amount of money every week, usually between three and four per cent of their wages, if they are not more than five marks a day; but the employer usually contributes by far the larger share. Moreover the workingmen's payments are voluntary.

The Jena System.

Welfare work of this kind did not meet with the approval of one of the most remarkable men that Germany has produced. He was the late Prof. Abbe, the associate of Carl Zeiss, who founded the great optical works at Jena. Abbe felt that because all industrial welfare work is largely philanthropic it is radically wrong in principle. The employee should receive the benefits of insurance, of pension systems, of proper sanitary conditions in the workshop, of free medical attendance in case of sickness, not as a beggar receives alms, but he should be able to demand them as a matter of right. Accordingly Abbe devised a system which, on paper, would seem to be hopelessly impracticable, but which has proven brilliantly successful in actual practice.

His vast fortune Abbe converted in his lifetime into a trust fund for the benefit of his employees. Their rights to that trust fund were codified in a set of rules, "statutes" Abbe called them. To give these the force of law Abbe had them accepted and ratified by the Grand Duchy of Saxe-Weimar, so that they became part of the Duchy's laws.

Every manufacturer pays his men according to the market price. Abbe devised a different system. At Jena wages are paid on a basis determined by three distinct elements—a minimum weekly wage; the amount actually earned, and a supplementary wage payable at the end of the financial year. The minimum wage is fixed. It cannot be reduced but must always rise. If the times are bad, if there is a breakdown, if a legal holiday intervenes, that fixed minimum wage is always paid. What he earns above that wage depends upon the workingman's ability. The supplementary wage, which is in the nature of a bonus, is of course dependent to a certain extent upon the amount of business done in a year. During the fifteen years in which the system has been in force an average annual bonus of eight per cent has been paid. Overtime work, night work, Sunday and holiday work are paid for at a higher rate.

In 1900 it occurred to Abbe that nine hours a day are more than any man ought to work. Accordingly the workingmen were asked by the board of managers whether they were willing to turn out the same amount of work in eight hours and receive nine hours' pay. The vote was overwhelmingly in favor of the change. For the last twelve years the works have been placed on an eight-hour basis.

After one year's service every employee in the works is entitled to six days' holiday with full pay and six days without pay. If the vacation thus allotted is not taken in one year it may be added to the vacation of the following year.

Abbe had interesting ideas on the obligations of the employer. He regarded as monstrous a system under which a man is employed with the tacit understanding that the employment is to be permanent, yet permitting the discharge of the man at any moment if the employer so wills. The opportunities which the employee might have embraced have been lost, perhaps forever. Abbe regarded it therefore as socially desirable that men whose services are no longer required should be furnished with enough money to keep themselves while seeking new work. Hence he devised a method of legally securing a workingman who may leave the employ of the firm. After a service extending over three to five years a dismissed workingman is legally entitled to full wages for six months. If he has been employed for a shorter period, he receives less. Only grave misconduct and repeated breaches of the "statutes" constitute sufficient grounds upon which the payment of compensation may be refused. A man, for example, who has been in the employ of the firm from three to five years and has been earning a minimum weekly wage of 25 marks ($6.25) would receive a compensation of 650 marks ($162.50) on leaving.

The University of Jena, too, was given a claim on the trust fund; for Abbe felt that without scientifically trained men the optical works could not endure. Hence he saw to it that among the graduates of that famous institution there are always a number of competent mathematicians and chemists who can be taken over by the scientific staff of the works.

Nowhere in all the world can be found so shining an example of science applied to the sociological problems of a great industrial corporation as at Jena. Abbe's scheme has proven brilliantly successful because it was conceived by a man who had brains and a heart.

Workingmen's houses at Nurnberg, in which chiefly machinists dwell.

A glimpse of the workingmen's colony of the Krupp cast steel works at Essen.

WELFARE WORK IN GERMANY

The Influence of Light upon Ferments

SUNLIGHT tends to reduce the activity of certain ferments, or even to destroy it in the presence of air or oxygen. In order to find out whether this action varies with the different light rays present in sunlight, Henri Agulhon made experiments.

When ultra-violet rays were made to act upon sucrase, laccase and tyrosinase placed in a vacuum, these ferments were partly destroyed. In the presence of oxygen, the effect was much stronger. When visible light was used, there was no effect whatever in the absence of oxygen. Since the destructive action is presumably an oxidation, it is necessary to account for the action *in vacuo*. Mr. Agulhon accounts for the processes by referring to the results of Miroslav Kernbaum's experiments upon the action of ultra-violet rays on water. Kernbaum found that these rays decompose water, thus introducing free oxygen. When the action is in a vacuum, the excess of hydrogen is liberated; but in the presence of oxygen, hydrogen peroxide is formed. That this is the true explanation of the effect of ultra-violet rays upon the ferments is further inferred from the fact that laccase and tyrosinase are entirely destroyed after four hours in the presence of only one-half per cent of hydrogen peroxide. Of course the presence of water is assumed in all cases.

That the water is concerned in the action of ultra-violet rays upon the ferments is shown by an experiment in which a glycerine solution of tyrosinase was exposed in quartz for three hours without suffering any deterioration.

But other ferments do not behave in the same way. Emulsin is decomposed even by ordinary light acting in a vacuum. The ferment catalase taken from the fat of swine and from the liver of calves was used in experiments with visible light and with ultra-violet light. This ferment was also destroyed by daylight in a vacuum, although not as rapidly as in the presence of oxygen. But the destruction of the ultra-violet light was considerably less in the absence of oxygen.

A third type of effect is shown by rennet. This ferment is unaffected by visible light, but is readily destroyed by ultra-violet rays either in the presence or absence of oxygen.

Mr. Agulhon summarizes his work by classifying the ferments into three classes, according to the action upon them of light rays.

1. The first group contains ferments like sucrase, laccase and tyrosinase. These are attacked by visible light in the presence of oxygen, and are rapidly destroyed by ultra-violet rays even in the absence of oxygen. This is simply a case of oxidation and is easily explained.

2. In the second group are catalase and emulsin. These are destroyed by all rays *in vacuo;* more rapidly in the presence of oxygen.

3. A third group is represented by rennet. This behaves toward ultra-violet rays like the others, but is unaffected by visible light.

Whether the differences in the behavior of these ferments are due to the presence of other substances with the ferments, or to the nature of the ferments themselves, is not known.

Photo-electric Antimonite

NATURAL antimonium sulphide (antimonite) has been found to possess a photo-electric sensitiveness similar to that of selenium, but for there being no troublesome inertia. In fact, immediately after discontinuing the action of light, the electrical resistance returns to a figure practically identical with the initial "dark" resistance. The sensitiveness, however, disappears on melting or pulverizing the mineral, which suggests a connection with its crystalline structure.

In a paper recently submitted to the Royal Academy of Sciences, at Amsterdam, J. Olie and H. R. Kruyt examined the behavior of artificial antimonium sulphide, heated in sealed evacuated tubes of high-melting glass, raised in a special furnace to a temperature of about 650 deg. Cent.

Absolutely pure antimonium sulphide is found to possess a photo-electric sensitiveness comparable to that of natural antimonite, its conductivity sometimes rising from 100 to 500. Much higher effects could, no doubt, be obtained by an increase of the surface. The composition of the glass seems to exert a marked influence on the success of the experiment.

The Creation of a Dignified Civic Center in New York

Restoration of Historic City Hall Park by Removal of Unsightly Buildings

THE Department of Bridges of this city is to be congratulated upon the admirable study which has been made under Commissioner Arthur J. O'Keeffe, of the problem of restoring City Hall Park to its original condition and forming around it a civic center of becoming dignity. The work proposed is shown very clearly in the two engravings on the front page of the present issue, and particularly in the bird's eye view showing the appearance of City Hall Park when it shall have been surrendered once more for the sole occupancy of that beautiful and historically interesting gem of architecture, the City Hall.

Apart from City Hall, not one of the several buildings which encumber the park can be said to have serious pretensions to architectural merit, not at least to architectural merit as such an important center as this demands. The removal of the Post Office building will render it possible to obtain an unobstructed view of the City Hall from Broadway, and the removal of the so-called "Tweed" building to the rear of the City Hall, and the unsightly structure to the east of it, will open up to view the imposing and handsome Municipal Building, which should be completed before many months have gone by. The new Court House is to be built to the north of the Municipal Building, and to the north again of this will probably be erected the new Post Office. A feature which will provide at once safe and comfortable access to the Brooklyn Bridge Terminal Station will be the capacious bridge which is to be built from the park across Park Row to the second story of the bridge terminal.

The sectional view on our front page is drawn so as to show the inner workings of this very important transportation center, comprising as it does, the present Subway, Center Street loop, Third Avenue Elevated, and the new terminal for the Brooklyn Bridge, and having more transportation facilities within the area that it covers than any transportation center in the world. The picture shows the present Interborough Rapid Transit Subway on the left and on top the cars of the Metropolitan System on Center Street. Under the Municipal Building is shown the subway connection with the Brooklyn Bridge *via* the Center Street loop, a mezzanine floor for distributing the passengers to the trains and a connection with the mezzanine floor of the present subway. Over Park Row is seen the connecting bridge between the Municipal Building and the head house of the Brooklyn Bridge Terminal. Back of this is the Third Avenue Elevated Railroad terminal, which is not shown in the picture.

Of particular interest to dwellers in Brooklyn will be the section of the head house and train shed of the proposed new Manhattan approach to the Brooklyn Bridge. On the lower floor is a subway connecting the bridge promenade with the present subway by several stairways, and also connecting with North William Street. In the lower right-hand corner is shown a train on the bridge subway connection, which is a continuation of the tracks shown under the Municipal Building. Directly over this is the south driveway and on this same floor is the bridge promenade with its spacious openings from Park Row, bounded on both sides by the driveways, and extending out to the bridge proper. From this promenade stairways ascend to the mezzanine floors for the elevated trains and to the respective trolley loops. The mezzanine floor is connected over Park Row by the bridge, reference to which was made earlier in the article, and people approaching the City Hall destined for the elevated trains over to Brooklyn -or Third Avenue will ascend the stairway shown on the left of the picture, cross over the new promenade bridge and enter the building on what is shown as the mezzanine floor. From this they are conducted to the concourse or train floor by escalators and stairways.

The incline shown in the foreground is an escalator which conveys people from the street level directly to the concourse floor and is located in the middle of the building. The concourse floor is provided on both sides with ticket booths and is glassed in on the east end so as to prevent a draft from the train shed. After arriving on the concourse floor, passengers for the elevated trains will pass through doorways, depositing their tickets, and will arrive upon platforms provided for outgoing passengers. On the extreme right and upper floors are shown the elevated railroad trains, and the plan provides for separate platforms for the loading and unloading of passengers. The platform in the immediate foreground is an unloading platform, and the passengers passing out from this platform descend the stairways to the mezzanine floor, to the street level, or to the subway. These stairs are for incoming passengers, separate stairways being provided for outgoing people.

Another advantage of this new terminal is the removal from City Hall Park of the present temporary unsightly train shed and the returning to the city for park purposes of about fifty feet of City Hall Park. Furthermore the plans eliminate the crossing of tracks by providing an ornate overhead approach from City Hall Park. In the event of the reconstruction of the Brooklyn Bridge to increase its capacity, the completion of this Manhattan station of the Brooklyn Bridge will meet any requirements that such reconstruction might produce.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Correction

To the Editor of the SCIENTIFIC AMERICAN:

My attention has been drawn to the statement printed in your report of one of the recent automobile shows in New York city, to the effect that a certain three-wheeled gasoline motor car is my work. I wish to state that I have no connection whatever with this enterprise, and that any use of my name in connection with it is fraudulent. HIRAM PERCY MAXIM.

Hartford, Conn.

Lighting Copenhagen from Trolhattan

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of the SCIENTIFIC AMERICAN of February 10th, page 125, under heading of "Electricity" you have a note which is quite inaccurate. The heading is "Lighting Copenhagen from Trolhattan, Norway." The trouble is that Trolhattan is quite a way from Norway, and never has been and probably never will be in Norway, but is in Sweden and has always been so. The man who wrote this note must have been lame on his geography or else have used the system of lumping things, like a goodly number of the Americans do to try and hide their ignorance in geography.

The only objection to this statement is that the Swedes do not relish having their industries credited to Norway. "A SWEDE."

Crookston, Minn.

How to Build Roads

To the Editor of the SCIENTIFIC AMERICAN:

I note in your issue of February 10th the promise of a Good Roads number on March 16th. Of all general utilities the public highway is without doubt the one that should concern the greatest number of any and all communities. It is something we are to have (like the poor) with us always, and the best methods of construction and maintenance should engage the wisest counsel and careful thought. We are to build, not for the present alone, but for future generations; and that the burden may be more equally borne, it is believed by the writer that a plan which constitutes the issuance of long-time (thirty to fifty years) bonds, bearing a low rate of interest, to be voted for by the various communities through which such roads are to be built, would be the best solution of the problem. The history of past bond sales has proved that there are at all times large sums of idle capital seeking investment, and if a gigantic loan corporation for road-building bonds were once formed, the public would soon do the rest.

Crab Orchard, Ky. EDGAR G. DICK, M.D.

Gyroscopic Action of Steering Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of February 10th, 1912, appears an article on "Difficulties of Steering Aeroplanes" by S. S. Jerwan. If a student of aviation, who has not yet got his certificate, might criticise an aviator's views, I would like to submit the following:

The reason for the machine in question—in which the propeller revolves from left to right, from the pilot's viewpoint—having a tendency to turn to the left is: "action and reaction being equal and opposite," the torque of the motor tends to depress the left wing, which the aviator unconsciously warps to counteract this effect. The left wing now presents a greater resistance to the air than the right, and therefore slows the left side of the machine, making it turn to the left unless the rudder is brought into action.

There could be no gyroscopic effect until the gyroscope (the revolving parts) had some force applied to turn it out of its plane of rotation. So as long as the machine travels straight gyroscopic action can have nothing to do with its behavior, and would have a tendency to dampen rather than to augment any departure from the straight and narrow path. But if the machine in question turns to the right the precessional movement of the gyroscope tends to lower the nose of the machine and if to the left to raise it. Similarly a sudden dive would turn the machine to the left and a sudden rise to the right.

If Mr. Jerwan's machine behaves differently it must have an engine running clock-wise when viewed from the front, or else the phenomena is not due to gyroscopic action. If the latter is the case, by nice adjustment he might make the unknown and gyroscopic force balance and have an ideal machine.

Toronto, Canada. CANADIAN SUBSCRIBER.

Should the Atmosphere be Conserved?

To the Editor of the SCIENTIFIC AMERICAN:

This is a serious question. Scientific men have seen the vital need of conserving the forests. They tell us that the melting snows of winter saturate the forests, which, like sponges, hold the moisture, relinquishing it little by little through the summer, thus maintaining a fairly uniform humidity for the year. We are further informed that excessive timber cutting on the water sheds engenders floods in spring and drouth in summer. But the conservationists, when first calling our attention to the necessity for preserving our standing timber, failed to make the most of one of their strongest arguments.

We are dependent upon vegetation for the removal from the atmosphere of that product of combustion, carbon dioxide, which we know to be inimical to animal life. Were man not undergoing a vast industrial expansion, the amount of carbon dioxide which his mere living exhales would amount to practically nothing. But he is tearing from the earth great strata of coal and feverishly uniting it with the atmospheric oxygen and pouring it back into the atmosphere from which nature once so carefully eliminated it.

Conflagrations among the forests and the abodes of men swell the increasing amount of carbon dioxide with which the atmosphere is annually burdened. Many industries, as, for example, the manufacture of lime from lime-stone by the addition of heat, are adding carbon dioxide to the air in ever increasing volume. Can our present yearly growth of vegetation, in abstracting this carbon from the atmosphere for its needs, completely balance the equation which man's industrial activity has created? This is a serious question indeed.

It will take much research before the writer can answer it. But the need of assistance in the search through the by-paths of statistics leads him to interest other minds in a subject which is obviously of vital importance. Aviators have noted inexplainable absence of available oxygen in the upper strata of the atmosphere. If there is danger ahead for the human race from this source, knowledge of it can come none too quickly. The bacilli beneath our microscopes, whose effluvium ultimately so poisons the environment as to destroy the colony, warn us that man himself is not above the possibilities of a like reaction.

The delicate adjustment between this function of vegetation and the carbon dioxide in the atmosphere is not the immediate subject of our query. Man is using up the atmospheric oxygen (aside from uniting it with carbon under his boilers and elsewhere) by combining it with solids where it must lie, unavailable, for ages. This oxygen is as much "consumed" as the coal, the iron, copper, etc., whose visible supply is said to be sufficient for but a few centuries longer.

Think of the amount of atmospheric oxygen that is yearly converted to a solid form by the natural oxidation or rusting of iron the world over. Then consider the gigantic metallurgical plants whose blast furnaces consume uncalculated millions of tons of oxygen each year which is discarded in the slag. The reduction of metals and the manufacture of steel lead in spending that most important of all natural resources, the atmospheric oxygen. Is then this still more delicate balance maintained?

If we are agreed that a time, not far distant, will find man without coal or iron, are we, because the atmospheric oxygen is invisible, to leave it out of our consideration until it is perhaps too late?

THORINGTON CHASE.

Model of head of which duplicate casts are desired.

Indian Heads Cast from Life

An Interesting Plan of the American Museum of Natural History to Further Ethnological Research

The glue mold within the plaster jacket.

THE origin of the primitive races of the New World and their possible relations to the geographically isolated races of the Old World is one of the most interesting questions of ethnological research, which if it ever comes to anything must needs reach its results through comparative study of the races themselves in their physical types and their cultures. In this country especial interest has attached to study of the Indian tribes of the northwest coast of North America for comparison with northern Asiatic tribes, with a view to establishing proofs of the derivation of the western tribes from the eastern, or at least of a mingling of the two during the age of land connection of the two continents. Interest has centered also in an investigation of the tribes of the Southwest and of the islands of the Pacific with reference to establishing possible connection between the Old and New Worlds at this point through the widespread Polynesians.

According to the *American Museum Journal*, to which we are indebted for the accompanying illustrations and descriptive matter, the American Museum has unusual hopes for the future of this research because of large equipment for the study in life casts of physical types. In 1906 the institution possessed more than five hundred masks from life, and the number has steadily increased until it has become a very complete collection. There is a full series of Siberian casts, actually made in the field on the Jesup North Pacific expeditions, a complete Eskimo series, made pretty much throughout the length and breadth of the Arctic regions, and an elaborate series representing every type of culture of the North American Indian, being especially strong for the Northwest Coast, the Plains, California and the Southwest. In addition the Museum possesses a scattering series for South America and the South Pacific Islands, representative of such races as Patagonians, Maori, Samoans, and Filipinos. Almost without exception these stand for actual field study of the given race and are accompanied by a long series of photographs and careful color studies for many subjects.

Ethnology draws many conclusions from skull study but these results must of necessity be incomplete as compared with records based on casts from life which give perfect contour of head and accurate detail of feature. The accuracy of the casts has steadily risen during recent years with the perfecting of methods of technique. Formerly the man who allowed a plaster mold of his head to be taken was subjected to considerable discomfort, which resulted in a cast in which the features were so distorted that it could serve only as a basis from which the sculptor modeled the finished bust; but since the paraffin method has been in use the cast can be gained without distress to the subject, therefore the expression remains true to life and all measurements are accurate. This removal of the necessity of doing any modeling on the casts and therefore of the sculptor's temptation to conventionalize his work has been a most important factor for truth in the ethnological investigations under way.

As may be supposed exhibition is one of the immediate purposes of the casts. If it is desired to study any given tribe, the exhibition hall shows not only the articles of its culture but also accurate representations of the people themselves. And furthermore, the Museum has continual demand for duplicate casts from universities and colleges and other museums, as well as from artists and various private parties interested in Indian or other primitive types of man. Thus, the collection extends its usefulness through sale, exchange and gift.

Japanese Treatment of Syncope

THE Japanese show their knowledge of anatomy not only in the *jiu-jitsu* method, but also in what is known as the *kuatsu*. The latter is used to restore persons from a fainting spell. The method consists in striking upon the back of the seventh vertebra of the neck when the subject is lying face downward. This vertebra is the one which is prominent at the base of the neck, and it is struck with frequent motion by the closed hand. A reflex nervous action is thus set up by the successive shocks, and although its exact nature is not known, the fact is that the regular action of the heart is restored and the subject comes to his senses. Then he is seated, and his arms are given a rotary movement which stimulates the circulation and breathing. He is then required to walk, so as to give a good circulation in the lower members, and if this is neglected there is danger that the syncope returns.

A large number of duplicate casts can be made from a glue mold.

The mold is like a jacket or hood, separated from the model by just the thickness of the clay. Model and jacket are given a coat of shellac and one of oil, then are put back in position and the space between them filled with glue.

Mr. James C. Bell making a glue mold of an Indian head. Glue is poured into a funnel opening into a space between the original model and the plaster jacket fitting over it.

MAKING DUPLICATE CASTS

Artificial Mountain Air

IN any large party of tourists who have reached the summit of a lofty peak without effort, by the aid of a modern mountain railway, there are usually a few persons who do not share the general enthusiasm and exhilaration, but lean heavily on their alpenstocks and evidently feel uncomfortable and oppressed. The ascent of a snow-clad peak on foot sharpens the appetite of all true mountain climbers, but it produces the opposite effect on certain individuals.

In both cases the abnormal symptoms are those of mountain sickness, which may be defined, in a general way, as the inability of the organism to adapt itself promptly, or at all, to changes in external conditions. At the extreme heights attainable in balloon ascensions the strongest of men are subject to this disability. Hence it is possible to classify persons according to the heights which they can attain without being affected by mountain sickness, but this classification cannot be absolute because the susceptibility varies with the general condition of the organism.

At one time mountain sickness was supposed to be caused chiefly by the fatigue of mountain climbing, combined with the influence of wind, atmospheric electricity and other climatic factors. This view was apparently supported by the fact that the morbid symptoms are alleviated by rest in sheltered situations, but most diseases are palliated by similar treatment. It was observed, furthermore, that such characteristic symptoms as insomnia and changes in the pulse and respiration often occur in persons carried to great heights without any bodily exertion. More importance, therefore, was attributed to the changes in external conditions, and especially to the diminution in atmospheric pressure at great altitudes and the corresponding diminution in the supply of oxygen. Each of these factors has been made the basis of a theory of the causation of mountain sickness.

In a recent issue of *Die Umschau* Dr. David expresses the opinion that the discomfort which many persons experience at great altitudes is caused chiefly by the diminution in atmospheric pressure. For most persons, according to this writer, a sojourn in mountain regions at altitudes up to 10,000 feet is wholly beneficial, and the benefit is due partly to objective and determinable factors and not entirely to the subjective influences of change of scene, environment and occupation.

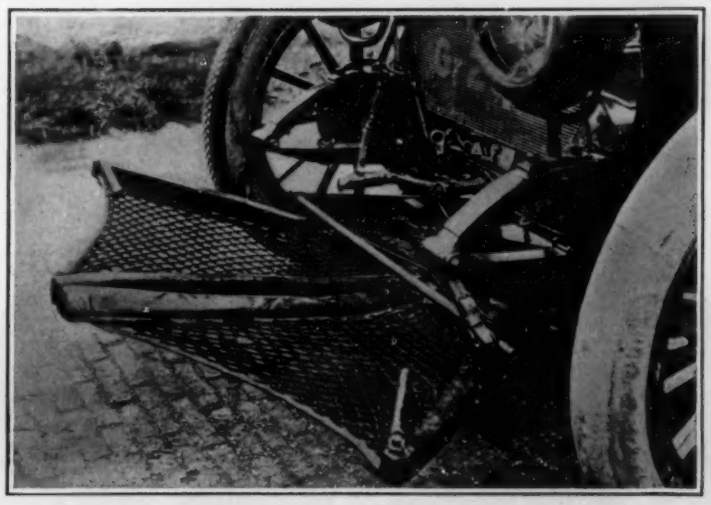
The character of the respiration, for example, is altered. Observation shows that at great altitudes and, in general, in an atmosphere poor in oxygen the volume of air inhaled and exhaled in each respiration is increased, while the number of respirations per minute remains unchanged. In this way a more thorough ventilation of the lungs is effected without greatly increasing the work done by the respiratory muscles. This involuntary, unconscious and effortless deep breathing is quite different, in its character and effects, from deep breathing practised laboriously under an effort of will, which may seriously overtax the heart.

It has also been discovered that the red blood corpuscles, the oxygen-carriers of the body, become much more numerous in the atmosphere of the mountains, and that this increase of these short-lived corpuscles is due to a more rapid production, not to a less rapid decay. The parts of the spinal cord in which these corpuscles are generated reveal, under the microscope, evidence of increased activity.

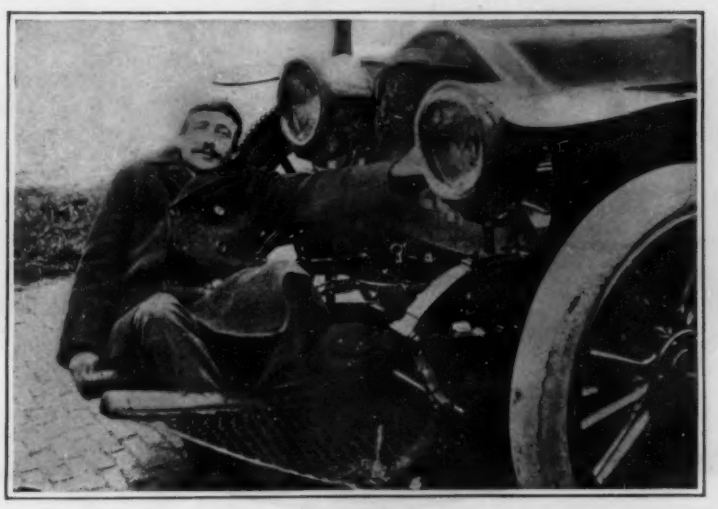
The deficiency of atmospheric oxygen probably stimulates other organs than the spinal cord to similar compensating activity, and Dr. David regards such stimulation as very beneficial, if not carried to the point of exhaustion. It is for this reason that mental workers are refreshed by moderate indulgence in walking and athletic sports, while men engaged in hard manual labor derive physical benefit from reading and other mental work. In each case comparatively idle cells are forced into action.

By courtesy of *Umschau.*

An apparatus for the production and inhalation of artificial mountain air. By maintaining normal atmospheric pressure mountain-sickness is avoided.



The automobile fender opens like a pair of scissors to give access to the starting crank.



Method of picking up a man with the scissors-like fender.

This stimulating effect of mountain air is revealed by the balance sheet of bodily receipts and expenditures. It has been found that if the albumen ration which is required to keep the body in normal condition at the sea level is consumed in the mountains the result is an accumulation of albumen, the most important constituent of the muscles and most of the organs.

The theory that the beneficial effects of mountain air are due to its poverty in oxygen receives additional support from Dr. David's discovery that the circulation of blood through the lungs of animals is increased by diminishing the proportion of oxygen in the atmosphere.

Certain pulmonary disorders in which the lungs are imperfectly expanded and ventilated, and some diseases of the blood in which the formation of new cells is sluggish are characterized by depression of the functions which are especially stimulated by a deficiency of oxygen in the atmosphere. In order to produce this deficiency of oxygen without the diminution in pressure to which Dr. David attributes mountain sickness, he has devised the apparatus herewith illustrated.

The patient's head is inclosed in a large air-tight box provided with glass windows and with a rubber collar so constructed that it makes an air-tight joint about the neck without producing uncomfortable pressure. The box is suspended in such a manner that it can be placed in any desired position. An electrically driven blower and a pair of wash bottles are connected with the box and each other by rubber tubes, forming a closed circuit in which the air circulates continuously, being freed from the injurious products of respiration by its passage through the wash bottles.

By means of a specially constructed valve, shown on the opposite side of the box, and connected with a reservoir of oxygen, a quantity of oxygen exactly equal to the quantity consumed in respiration is continuously admitted. The proportion of oxygen in the air can be reduced to the desired degree at the outset by drawing off some of the air and admitting nitrogen or some other inert gas through this valve, or gradually by connecting the nitrogen reservoir with the valve without drawing off air so that the oxygen consumed is replaced by nitrogen.

The ordinary atmospheric pressure is maintained in the box. The composition of the air may be determined, from time to time, by the ordinary methods of gas analysis, or a self-registering apparatus may be constructed to give a continuous graphical record of the proportion of oxygen. An air-tight cabinet which the patient can enter and in which he can move freely may be used to advantage instead of the box surrounding the head. A cabinet of this sort will soon be installed in a German sanitarium.

The results of the therapeutic applications of this apparatus that have been made, thus far, appear to corroborate the theory on which it is based. It does not aspire to rival the Alps, but is designed merely to produce some of the beneficial effects of mountain air without its disadvantages, especially in cases in which great altitudes are positively contra-indicated.

A New Automobile Fender

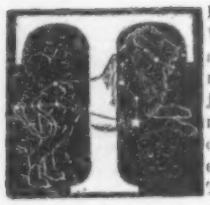
A NEW type of automobile fender has made its appearance on the streets of Paris. The fender consists of two members, which are opened and closed scissors-like. The accompanying illustration shows that each half of the fender consists of a frame, over which a netting is spread. The motor can easily be cranked by separating the members.

A Concealed Extra Tire.—By an ingenious construction of the seat back of an automobile, Dorah W. Wilt of University Place, Nebraska, in patent, No. 1,010,560, provides a casing in which the extra tire may be concealed so it is easily accessible by slightly tilting the back of the seat.

The Heavens in March

Some Notes on the Interesting Asteroid Vesta

By Henry Norris Russell, Ph.D.



THE brightest of the asteroids is Vesta, now just past opposition and well observable in the evening sky. The little planet is just too faint to be seen by the naked eye, appearing as a star of magnitude 6.7, but can be easily recognized in a field glass. The accompanying sketch map, showing the stars to the eighth magnitude in the planet's neighborhood, will make her identification easy. The brightest star shown on it is ϵ Leonis, which may be found upon our general map of the heavens at the end of the "sickle" of Leo. The two fainter stars between which the planet lies at the beginning of the month are about half way between ϵ and γ Leonis.

The distance which separates us from Vesta is 132,000,000 miles on the first of the month, and about 150,000,000 on the 31st, so that she is fairly near us, being in fact scarcely more remote than Mars is at the end of the month, though not by any means as near as Mars was a few months ago.

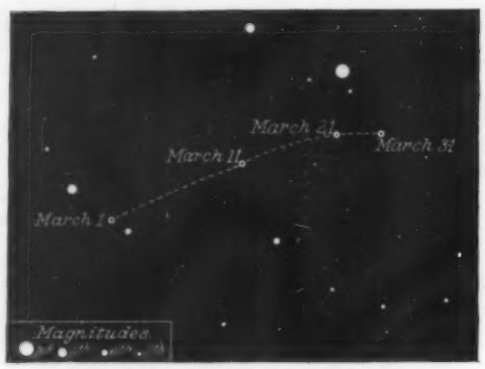
The present difference in brightness between the two is therefore a fair representation of the real difference. According to the Nautical Almanac, Mars appears on the 31st as a star of magnitude 1.3—a little fainter than Aldebaran. This makes him 5.4 magnitudes, or about 140 times brighter than Vesta.

Part of this difference, however, is explained by the fact that Mars, at that date, is 152,000,000 miles from the Sun, and Vesta 217,000,000, so that the intensity of the sunlight falling on the larger planet is double that which illuminates the smaller. We may therefore conclude that, if set up side by side, Mars would seem some seventy times as bright as Vesta. This number would need some modification for the influence of phase. Mars appears at present like the Moon three days before the full. In consequence he loses a good deal of light, both because we see a part of his dark side and because much of his visible surface is illuminated very obliquely and therefore feebly by the Sun.

Vesta, could we see her sufficiently magnified, would show a similar, but smaller, effect; and though we cannot observe the changes in her form, the corresponding diminution in her light can be measured.

Allowing roughly for this, it appears that if at the same distance and fully illuminated, Mars would appear rather more than one hundred times as bright as Vesta. If the two planets had the same reflecting power, i. e., if their surfaces were equally white, this would mean that Vesta's diameter was a little less than one-tenth that of Mars, or about 400 miles. Actual measures by Prof. Barnard show that the diameter is about 250 miles. It follows that the surface of Vesta must have a much higher reflecting power than that of Mars, which is not altogether surprising in view of the pronounced redness of the latter and the relatively white color of the former. All the asteroids, it is true, appear as yellowish stars, but this is only because they shine by reflected sunlight, and the Sun itself is a yellow star.

Concerning the actual characteristics of the little planet which we are considering, not much is known. She does not appear large enough, even in the most powerful telescopes, to permit the detection of markings on her surface. If the markings were very pronounced, we might hope to find variations in her brightness due to her rotation; but though such phenomena have been observed in the case of other asteroids, Vesta does not show them. So small a body doubtless has no more atmosphere than the Moon, and like her must be a "dead world" with no possibility of life or of any change on its surface beyond the occasional splitting of a rock under the influence of heat or cold.



Path of the asteroid Vesta during March.

The Heavens.

Anyone, even if he has never tried to identify a star before, can easily pick out the leading constellations with the aid of our map, by simply holding it so that the side marked with the point of the compass toward which he faces comes at the bottom. It will be well to begin in the southeast, with the brilliant groups of Orion, Canis Major, and Taurus. Above these, across the Milky Way, are the almost equally fine constellations Canis Minor, Gemini, and Auriga. Perseus and Cassiopeia may be seen in the northwest, and the two Bears and the Dragon in the northeast. Leo is high in the east, and the principal stars of Boötes and Virgo are rising. The little groups of Corvus and Crater are in the southeast, and below them is the long line of Hydra, extending from the southern horizon far up toward the zenith, the head of the monster being but a little east of Procyon and south of Cancer. An interesting object in the latter constellation deserves notice—the star cluster Praesepe, marked on the map. To the unaided eye, this appears as a mere hazy mass of light. A field glass resolves it into stars, just too faint to be seen singly without its aid. As in many other cases, most of the stars of this cluster are moving together in the sky in the same direction and the same rate, so that it is practically certain that they are really neighbors. In the case of Praesepe the motion is apparently very slow, and this, coupled with the faintness of the stars composing it, makes it natural to suppose that this cluster is at a great distance—probably such that its light requires several hundred years to reach us.

The Planets.

Mercury is in conjunction with the Sun on the 2nd, and is an evening star for the rest of the month. He is best visible about the 27th, when he is apparently farthest from the Sun. The conditions for observing him are unusually good at this time, for he is as far north of the Sun as he can get. He may very easily be seen in the twilight, as a star-like object brighter than any of the fixed stars except Sirius on the borders of Pisces and Aries, setting a little before 7 P. M.

Venus is morning star in Aquarius, rising about 5:15 A. M. in the middle of the month.

Mars is in quadrature with the Sun on the 4th, and comes to the meridian at 6 P. M. He is still conspicuous to the eye, appearing about as bright as Aldebaran, and moving slowly eastward through Taurus, but telescopically he is not much of a sight, showing a disk only 7 seconds in diameter, on which very little detail can be seen.

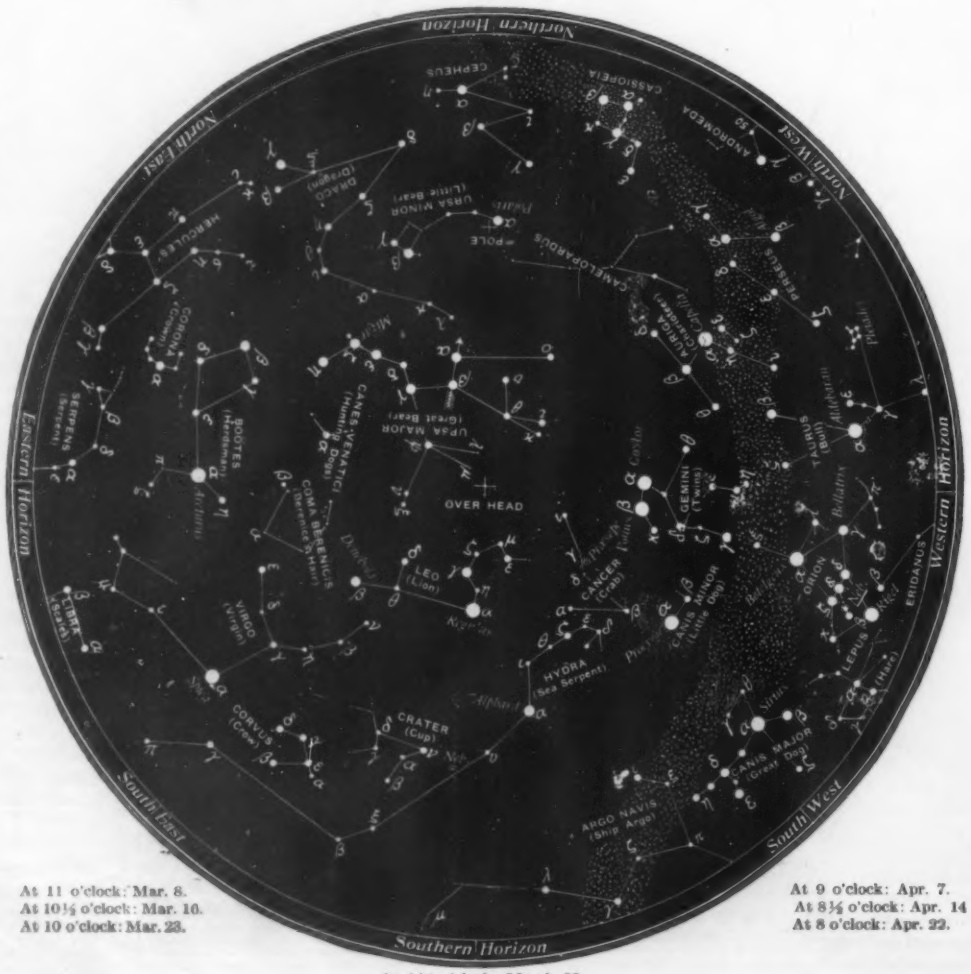
Jupiter is in quadrature with the Sun on the same day as Mars, but is a morning star, on the opposite side of the heavens, in Scorpio. Being so far south, he does not rise till an hour after midnight.

Saturn is evening star in Aries, setting about 11 P. M. at the beginning of the month and 9 P. M. at its close. Uranus is a morning star in Capricornus, and is hardly observable, as he rises about 3 A. M. and is still very low at dawn. Neptune is in Gemini, crossing the meridian about 8 P. M. in the middle of the month.

The Moon is full at 5 A. M. on the 3rd, in her last quarter at 2 P. M. on the 10th, new at 4 P. M. on the 18th, and in her first quarter at 9 P. M. on the 25th. She is nearest the Earth on the 1st, and again on the 28th, and farthest away on the 12th. As she moves around the skies, she passes by Jupiter on the 10th, Uranus on the 14th, Venus on the 16th, Mercury on the 20th, Saturn on the 22nd, Mars on the 25th, and Neptune on the 26th.

At 6:21 P. M. (by Washington time) on the 20th the Sun crosses the celestial equator, and passes over that point in the heavens known to astronomers as the vernal equinox. If the Sun was a mere speck, rising instantaneously, and if there was no refraction of light in our atmosphere, the day and night would be of equal length on this date. As a matter of fact, we count sunrise from the moment when the upper rim of the Sun appears (not its center) and the atmospheric refraction apparently raises the Sun,

(Concluded on page 204.)



At 11 o'clock: Mar. 8.
At 10½ o'clock: Mar. 16.
At 10 o'clock: Mar. 23.

At 9 o'clock: Apr. 7.
At 8½ o'clock: Apr. 14
At 8 o'clock: Apr. 22.

At 9½ o'clock: March 30.

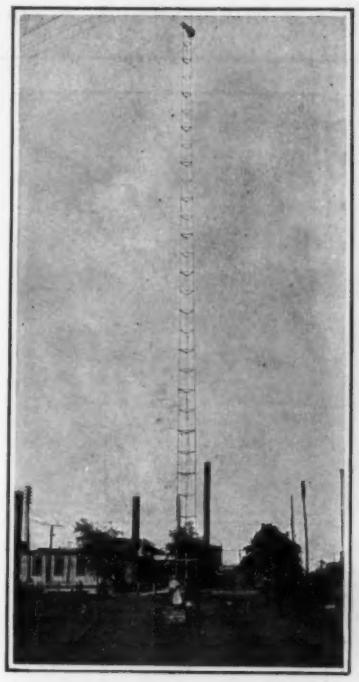
NIGHT SKY: MARCH AND APRIL

Curiosities of Science and Invention

READERS are invited to contribute to this department photographs of novel and curious objects, unique occurrences, and ingenious contrivances. Such as are available will be paid for promptly.

A 125-foot Portable Photographing Tower

A UNIQUE aerial photographic apparatus has been developed at Worcester, Mass., for taking bird's-eye views of manufacturing plants. The apparatus consists of a light tower with an equipment for raising and lowering the camera and holding it in position at the top. The tower is sufficiently rigid when erected to hold an 11 by 14-inch camera so as to take a very sharp negative. It is so light that two men operate the apparatus with ease, and when taken down, the sections telescope into such small space that the whole can be conveniently shipped by express or freight. In operating this apparatus, the focus and field of the camera are determined mathematically. When the tower is in position, the camera is drawn up over pulleys and locked into position on the holder. Electricity is employed to operate the shutter. This device was employed during the past season with much success.

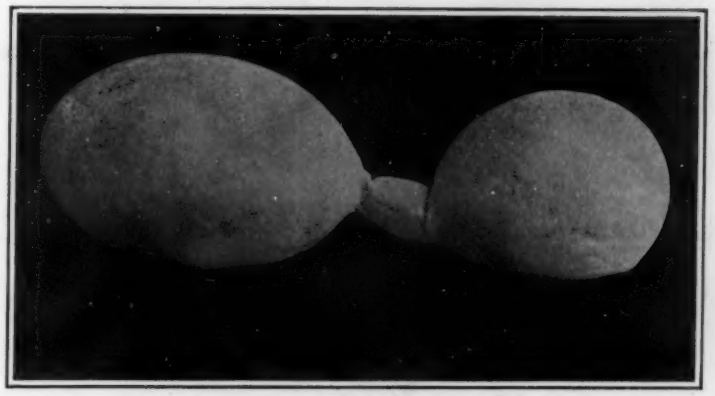


Photography with a 125-foot tripod.

A device that warns linemen of live wires.

A Double Hen's Egg

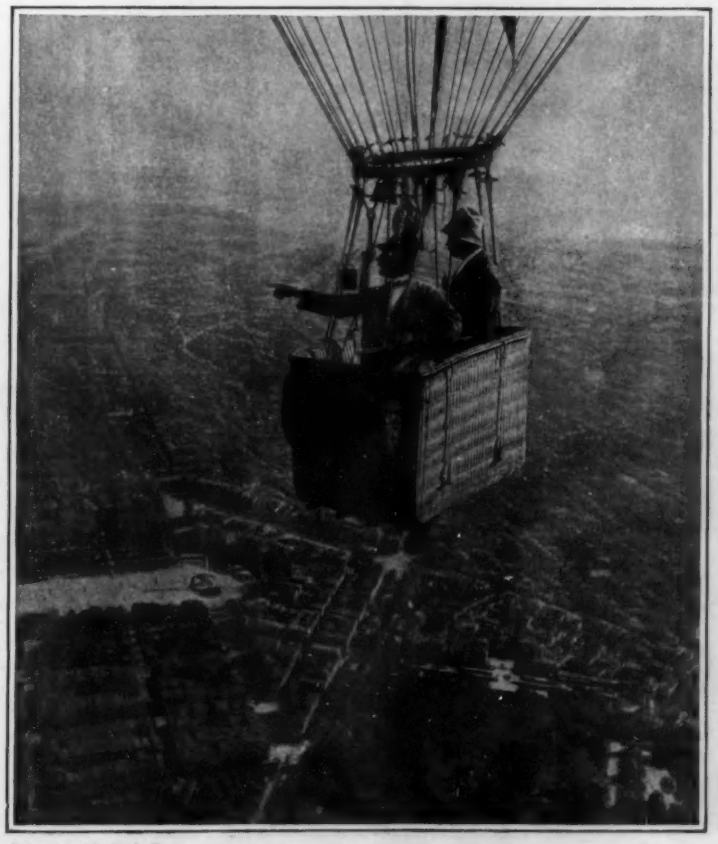
A RESIDENT of Pahiatua, New Zealand, has sent us a photograph of a curious double egg found in the nest of a white leghorn. We who are obliged to pay exorbitant prices for eggs should take great interest in this peculiar freak of nature. Apparently the ambitious fowl that laid the egg was of a frugal disposition, albeit determined to give good measure, for she dispensed with a shell, and yet despite this omission the pair tipped the scales at 4½ ounces. Evidently this was a supreme effort, because our correspondent does not tell us of any other eggs of the same character. It is a pity that some Burbank of the animal kingdom does not make the acquaintance of this hen, to encourage her in her efforts, and breed others of her type.



Curious egg laid by a New Zealand hen.

Photography in a Balloon

IT is a simple matter to take photographs of one part of a dirigible balloon from another point on the same airship because the car is of sufficient length to provide all the range of action desired. The same is true to a more limited extent of aeroplanes. But when it comes to photography of this character in a spherical balloon the task is exceedingly difficult. The basket is so small that if pictures of it are to be taken the camera must be supported at some point outside. One daring aeronaut took pictures of his car by climbing up into the balloon rigging. A less perilous scheme has been worked out by two European aeronauts, each working independently of the other. The accompanying photograph shows the striking result obtained by one of these experimenters. The camera is suspended by means of cables attached to the balloon net. The apparatus may be raised or lowered as desired, and then the occupants of the car may take their own pictures by using a simple device to spring the shutter. The photograph we publish was taken at a height of 2,000 feet above the city of Bordeaux. The camera may be raised or lowered and tipped to any angle desired, so as to photograph the basket from almost any point of view except a direct plan view, which is hindered by the bulge of the bag and the tangle of ropes.



By courtesy of *Le Monde Illustre*

Taking his own photograph 2,000 feet above the ground.

Live-wire Detector

A VERY convenient little indicator known as the Sauvevie, or "life saver," is used in France for finding out whether wires are carrying current or not. It is made for use in connection with lines of high voltage lying between 1,000 and 10,000 volts. The device is to be recommended because it may very conveniently be carried in the pocket. The body has the shape of a watch, and it is removable from the ebonite rod. An important point is to see that the device is in good working order just before using it. A light swinging arm works on a pivot and is attracted to the fixed metal piece lying below when the wire is alive. To test the instrument, the ebonite rod is taken off and the watch portion is set up in a steady position. Then the rod is rubbed briskly on the coat-sleeve so as to electrify it and is brought near the top ball. When all is in good order, the pivoted arm swings around and so indicates the electric charge. One is thus sure that a live wire will carry out its effect, and the watch part is then mounted on the rod and held up with the ball near the wire. The ebonite rod serves as a handle to insulate the top part and keep the charge from entering the body.

A Freak Peach Tree

THE country round about the French town of Montreuil-sous-Bois is noted for its splendid peach orchards. In one of these there was noted a tree in 1908 with the peculiarity that one of its branches had the characteristics of the almond tree. This branch appeared in the angle above one of the limbs that had been removed, more than seven feet from the swelling produced by the original graft. But in 1910 several almond twigs appeared near the first, and some on a pruned branch lower down. Finally, on a neighboring tree almond branches also shot out at the time of the flowering of the peaches.

The peach trees upon which these almond sprouts appeared were cultivated in a fruit-wall, and had been grafted on almond stock. They were from sixty to eighty years old, and had begun to show signs of declining vigor. In 1911 one branch blossomed at the end of March, bearing true almond flowers; these are white and much larger than the bright pink blossoms of the peach. The fruit started to develop on these branches in the elongated form characteristic of the almond, but they dropped before reaching the length of one inch.

Several explanations have been suggested for this strange production of almond shoots on the peach tree. One is that almond grafts had been put in years before and had borne buds which had remained dormant for a long time, and then developed when the conditions were for some reason peculiarly favorable. In this particular orchard that was positively known not to be the case. Another explanation is that the tree is a hybrid, and is reverting in its old age to the character of one of its parents. A third explanation offered is that the peach tree is a cultivated almond, and may under certain conditions return to the type.

None of these proposed explanations is satisfactory to the biologist. For this reason a number of French botanists have undertaken a series of experiments in connection with this tree that are calculated to throw some light on the problems involved. Almond twigs have been grafted upon peach stocks, and the attempt will be made first of all to obtain seeds from these almond grafts. Then the experimenters intend to grow almond trees from these seeds, so as to compare the almond stock with the scions, and also to compare the sporting almond branches upon the peach tree with the original almond stock.

It has been frequently asserted that some almond trees bear now almonds and at other times peaches; it has also been said that peach trees sometimes produce fruit of distinct varieties, without grafting. But these statements have not been authoritatively verified.

What Inventors Are Doing

Simple Patent Law; Patent Office News; Inventions New and Interesting

An Automatic Change-maker

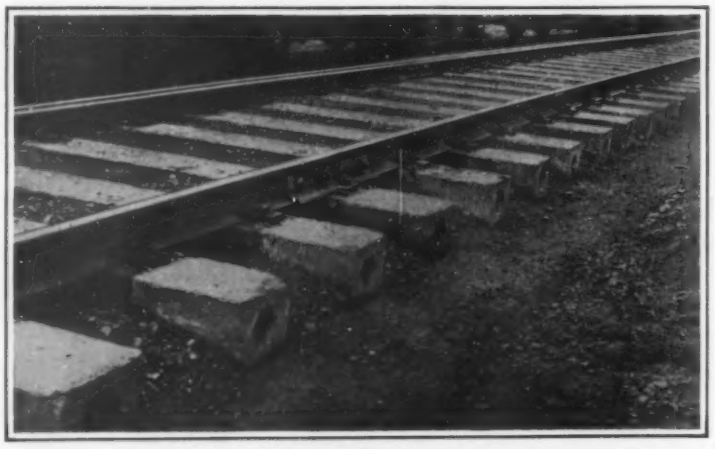
A MACHINE has been designed to change coins with absolute accuracy. The change-maker is mounted on top of a pedestal which is arranged for receiving fares or admissions. It is operated either by hand lever or by a foot lever, the latter at the same time operating the fare box. The model illustrated has a capacity for making change from one dime to one dollar, inclusive. All coins for which change is required are dropped into the one slot shown at the upper left-hand corner, the coin being stopped by a gate in position to be manipulated by a movable plate above, actuated by the operating lever. The lever being depressed, the coin is forced downwardly and to the left against a yielding plate which sets a sliding bar in position to eject coins from the coin stacks as shown. The various sizes of coins set this plate in various positions whereby selection of the particular coins to be ejected is made.

The lower part of the arc of travel of the operating lever is used for ejecting the change into a cup, shown below in the center of the machine, from whence it is removed by the hand. The fare or admission is then selected and dropped into the fare box below. The return of the operating lever to rest deposits the admission coin in the pedestal out of reach of the operator and returns the parts of the change-maker to positions for receiving and making change for another coin. If a coin such as 5 cents, 1 cent, or $5 is dropped in the slot, a partial depression of the lever locks the mechanism and prevents the ejection of any coin. The only alternative is for the operator to raise the operating lever slightly above its point of rest, whereby the coin is passed into the delivery cup without further action of the machine.

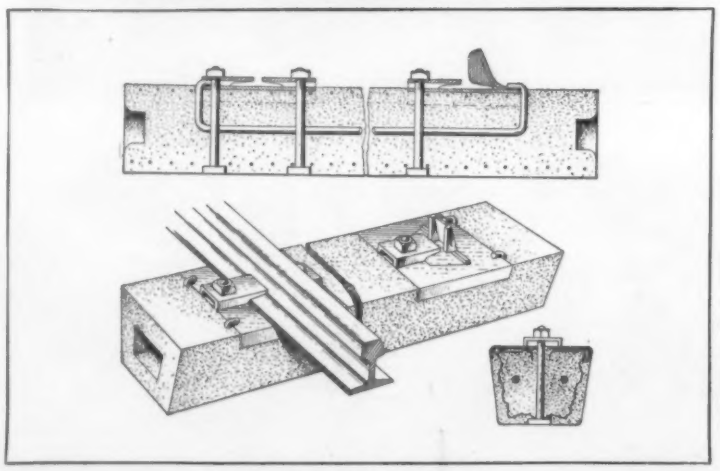
The operation of the machine is positive, without the intervention of any springs, springs being used only for returning parts to their original positions. From one to two seconds only being required for each person to secure change, select the coin, drop it into the fare receptacle and pass on. The machine is locked to the pedestal, and when the operator desires to leave the machine, by turning the key, shown to the right, and removing it, the lever is locked. Any coins dropped in the receiving slot immediately pass through to the delivery cup without operating any part of the machine.

The fare box is composed of a rotating, cylindrical segment, whereby the patron is permitted to correct an error in fare before the coin passes beyond his reach. The machine is adapted for having a counter or register attached thereto, and may also be arranged to abstract one or more fares mechanically. Provision is also made for changing bank notes.

The reinforcement of the tie is in the form of a wire cage.



A curve on the Panama Railroad laid in concrete ties.



Constructional details of the tie.

Concrete Ties on the Panama Railroad

ONE of the men employed in the construction of the Panama canal has designed an improved form of concrete tie that appears to stand up very well under test. The inventor, Mr. Sigmund Friedman, obtained permission to lay a hundred of his ties on a curve of the main line of the Panama Railroad. This road is of broad gage and the traffic, because of the canal building, is unusually heavy. The ties were made with the tie-plates set exactly to gage, as the inventor was ignorant of the fact that the spacing is slightly increased at curves. As a consequence, the first train to pass over this section of the track sheared slivers of steel off the rails. But the ties held perfectly and are still in good condition after several months of service.

The construction of the ties is indicated in the drawing. A heavy wire cage is used for the reinforcing. This is shown roughly in the cross-section and may be seen also in one of the photographs. Plates are imbedded in the tie for the rails to rest upon and tie rods serve to hold the plates in place. Clamps are secured on these plates by bolts that pass up through the tie. The plates at the outside of a curve are stamped out to form a chair, as shown at the right in the drawings. The ends of the ties are recessed to facilitate handling them. To test the maximum strength of the construction a tie was supported on rails at the rail plates and loaded in the center. A load of 2,145 pounds showed a deflection of 0.02 inch. At 7,150 pounds the deflection was 0.25 inch. Two cracks appeared on the side next to the rails and extended up for 2 inches. Under a load of 7,865 pounds cracks showed every 6 inches. As the load was increased the deflection was progressively greater, reaching 1.04 inches at 15,015 pounds and 1.54 inches at 16,445 pounds. Large cracks showed and the tie began to crumble. At 17,160 pounds the tie failed. It did not break into two pieces, but sagged gradually in the middle. The effect of the test was to show that the ties were very rigid under normal loads.

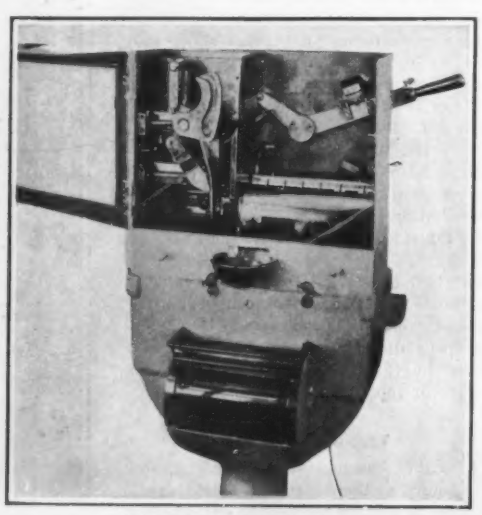
Annual Report of the Commissioner of Patents.

THE Commissioner of Patents, the Hon. Edward B. Moore, has just transmitted his annual report to Congress, and while this report is for the calendar year as re-

The change maker.

The coin receiver.

The coin tray.



The operative mechanism.

A MACHINE THAT CHANGES COINS

quired by law, it embodies many of the features contained in Mr. Moore's fiscal year report to the Secretary of the Interior. Mr. Moore is required by law to make two annual reports, being one of the few government officials at Washington charged with this double labor. The additional report, however, enables Mr. Moore to place before the legislative bodies those important measures which he has so long been vigorously advocating.

Outside of the legislative programme which Mr. Moore mapped out for the Patent Office as far back as the Sixtieth Congress, and which he is still urging the necessity for, the Commissioner's chief hobby is the building of a greater Patent Office. He has ridden this hobby hard, and in spite of repeated rebuffs comes up to the post at this season just as fresh and as strong as ever. He says that he has repeatedly urged that Congress expend some of the Patent Office surplus for this crying need. He points out to the country's lawmakers that the Patent Office has already on hand in the treasury more than seven million dollars—$7,063,925.76 to be exact—every dollar of which has been earned by the office in the transaction of the public business, and which has been paid in by the inventors and manufacturers of the country in the prosecution of patent applications. The Patent Office has served the people well, and the people have contributed to that handsome surplus, consequently, the Commissioner argues, both the Patent Office and the people should be afforded that relief which can only come through either enlarging the present quarters or by building an entirely new structure to house the workers, the archives, and the thousands of models.

He further discloses the fact that the priceless records of the office are in constant danger of destruction by fire in the present old-fashioned building, and shows that the necessity for using every available inch of storage space has resulted in some of the books and records being destroyed by dampness and decay. Many of the employees are forced to work in the basement, completely surrounded by stored copies of patents and other miscellaneous records, none of which can be disposed of, as most of it is constantly in demand.

The late Senator Daniel introduced a bill in the Sixty-first Congress which represented perfectly the Commissioner's views on the matter of a new Patent Office. This bill has been redrafted and will be introduced into the present Congress, and its passage urged as eloquently as Mr. Moore can express himself. The bill provides for the purchase of a site immediately in front of the Capitol and occupying a site similar to that of the Library of Congress. It is believed that such a site will be convenient, not only to attorneys and inventors arriving from out of town, but to persons within the capitol and library who have daily need to search the records of the Patent Office or consult volumes in the comprehensive Scientific Library.

The Commissioner represents that both Germany and Great Britain have recently been obliged to provide increased quarters for their patent officers, owing to the great annual growth of patents, trade-marks and designs. The pitifully inadequate and cramped quarters occupied by the United States Patent Office is a condition well-known all over the United States and is a matter in which every one should take a hand in aiding Commissioner Moore.

Court of Patent Appeals.

In his report the Commissioner expresses his hearty approval of the efforts of the American Bar Association to obtain legislation looking to the establishment of a court of patent appeals. Legislation to accomplish this should, in Mr. Moore's opinion, become law at the earliest practical moment. A patent granted by the government must be effective throughout the United States and Territories. When this patent, however, is involved in a suit which is brought in any judicial district, on appeal, the final decision is rendered by the circuit court of appeals of that jurisdiction. A decision involving the construction of a patent by the circuit court of appeals of one jurisdiction is effective only for that jurisdiction and has no legal effect in any other of the several circuits, except through comity. There have been in the past decisions rendered by several circuit courts of appeals which are directly opposed to each other. In view of the fact that a patent when issued is effective in all the States and Territories, it is very clear that there should be one court of patent appeals, whose decisions will control the status of that patent throughout the entire country. The importance of this is evident when it is considered that there are nine circuit courts of appeals and one Court of Appeals of the District of Columbia, and each of which may and often does entertain in some particular a different view from the others with regard to the same patent.

Needed Legislation.

The Commissioner reiterates his recommendations with regard to amendments to the laws which are needed to relieve certain existing conditions within the Patent Office. Four bills prepared by the Commissioner were introduced at the present session, being reintroduced in the same form as originally placed before two former Congresses. These bills are H. R. 7609, providing for the elimination of one of the appeals within the Patent Office; H. R. 7711, providing that photographic copies of drawings be filed with original applications for patent; H. R. 8388, requiring that an application for patent shall be prosecuted within six months after any office action, and H. R. 7710, providing for the issuance of certificates of correction in letters patent. These measures were discussed at length in the report and their passage urged.

Miscellaneous Matters.

Among the matters touched upon in his report, the Commissioner reports excellent gains in efficiency and economy and stated that the work of the Patent Office is in as good condition as present circumstances will allow. He also expresses his intention of a further system of reorganization, notably in the Scientific Library, where a thorough classification is necessary. He reports good progress on the present classification of United States and foreign patents, the work of which is now about half completed. An additional force is requested with a view to rushing this important work to an early completion. The work of classification when accomplished will result in an enormous benefit to the inventors and manufacturers of the country, and the outside public generally, since the work of examination of applications for patent will be much simplified and such patents as are granted will have a much greater degree of validity attached to them. The case of Everding, Barton and Heany is at an end, so far as the Patent Office is concerned, and the Commissioner praises the work done on this case by all concerned, and states that it is a matter of congratulation to the Patent Office and the country at large that this gigantic fraud was frustrated.

Some Interesting Statistics.

A very interesting and instructive set of tabulated statistics are made a feature of the Commissioner's Annual Report to Congress. These tables show in detail the moneys received by the Patent Office, and expended thereby. There are many sources of revenue, including fees upon filing of applications, final fees in patent, trade-mark, etc., applications; the making of certified copies of patents and assignment, the sale of printed copies of patents, the subscriptions to the *Gazette*, etc. The net receipts of the Patent Office during the year 1911, were $2,019,388.03, with expenditures of all kinds aggregating $1,953,689.91, showing a balance of earning of $65,698.12. Compared with the surplus of some of the other years, this is not so large as formerly, but since 1909, when it was necessary to increase the salaries paid the examining corps in order to keep highly educated technical men from resigning almost daily, the expenses on that score have been somewhat increased. The largest net surplus for any year since 1836 is shown to have been in 1883, when a balance of $471,005.14 was shown; the smallest net balance shown was in 1898, when but $1,538.28 remained after the expenses had been deducted from the receipts. Since 1862, however, there has not been a year when a balance was shown on the wrong side of the ledger, although previously to that year there had been about nine years since 1836, when a deficit occurred.

For 1911, there were filed 69,121 applications for patents, the largest of any year since the establishment of the office. A total of 34,084 patents were granted.

Notes for Inventors

A Suction Turpentine Cup.—Herman H. Boyer of Pensacola, Fla., has patented No. 1,009,641 a turpentine cup in which suction is utilized to draw upon a pipe inserted in the tree. His cup includes a cup with a piston head fitted snugly in it and a pipe which suspends the cup and communicates with the air space therein below the piston so that the weight of the cup and its contents will operate to cause a substantially continuous suction in the pipe to draw the sap from the tree.

A Water Main for Passenger Cars.—It has not occurred to many that a pipe-line water supply might be useful in passenger cars, but John D. Carter of Lawton, Okla., in a patent, No. 1,009,279, solves the problem by providing a tank in the car, a water distributing pipe leading from the tank along each side of the car past the several seats, and a return pipe connecting each distributing pipe with the tank, draw-off faucets being provided in the distributing pipe adjacent the respective seats.

Fraud Preventing Bottle.—Archibald A. McDonald of New Glasgow, Nova Scotia, in a patent, No. 1,009,078, presents a bottle whose attached label contains printing which is adapted to fade out and completely disappear after exposure to light, and means for excluding light from the label so the label can be preserved until the bottle is brought into use and the label uncovered when it will fade out and prevent its further use as a label.

Still Another Type of Cement House.—A cement house put together with a screw-driver is a novelty which has been recently introduced. The system is designed for houses of a more or less temporary character, or for houses that are liable to be moved from point to point such as a temporary work-shop or a private garage. The system consists of blocks of concrete in which has been buried a wire spiral with an opening in the cement to take a small bolt. These slabs are bolted in position over a metal or wooden frame, and when it is desired to move the structure the bolts may be readily removed with a screw-driver, and the whole structure transported without any damage to any desired point.

Cement Planks.—Cement lumber is a new form of making use of cement which dispenses with the necessity and uncertainty of mixing the material. The lumber consists of slabs made in suitable lengths, and this material takes the place of wood on the outside of a house. The framework is erected in the ordinary manner and a metal tie is nailed on the studding. The latter is galvanized and has a slotted edge. The ends of the slab come up to this and are held in place by bending the edge of the ties, first to one side and then the other, over the ends of the slabs. Subsequently the whole surface is finished by a coating of cement which fills all the crevices and covers the exposed portions of the tie. The metal tie costs two cents a foot.

A Mercury Vapor Draftsman's Tube.—The use of the mercury vapor tube has been largely restricted to factories and freight stations, but recently an improvement has been made by which it is made available for use in offices, drafting rooms and even stores and similar establishments. The tube instead of being in straight lengths is coiled so that the two ends are but a few inches apart, almost forming a circle. In the center there is placed a tungsten lamp. This combination gives a light that is white and comfortable to the eyes, and the shape permits of its being placed in a hemispherical globe which is secured by a circular frame secured to the ceiling, making a very desirable fixture.

A Simple Nut Lock.—An extremely simple nut lock is shown in a patent, No. 1,009,340, to John D. Prince, of New York city. It includes a continuous ring evidently made of wire with a twisted portion forming a lug for manual operation. A portion of the ring is eccentric to the remainder and the ring when applied to a bolt, up against a nut, lies in the groove of the thread of the bolt for part of one circumference, then crosses the intervening thread crown to its starting point being thus in engagement with the thread throughout its length.

Legal Notes

The Taggart Dental Inlay.—In 1907 a Chicago dentist by the name of Taggart secured a patent, No. 872,978, for a method for making molds for dental inlays and the like. Most people who have had any dental work performed in the last four or five years will recall the operation covered by this patent. In practising under the patent, a cavity in the tooth is made flaring so that a filling prepared in advance can be slipped into the cavity. When the cavity is prepared a pattern is made of wax pressed into the cavity and in contact with its surface. This pattern is in effect a wax filling and it is pushed into the tooth just as if the wax were going to be the permanent filling and it is trimmed up with a knife or other instrument so as to completely restore the contour of the tooth. The pattern of wax is then removed and stuck upon the end of a short piece of wire. A mixture of dental investment material is placed on the wax pattern in such manner as to form a mold from which the wax is melted and volatilized leaving in the mold a cavity of the exact size and shape of the desired filling. Into this mold cavity, melted gold is forced in any suitable manner and when the gold is hardened the mold is broken away, the gold is removed and the casting is cemented into place in the cavity of the patient's tooth. It is claimed that from the dentist's point of view, this process enables him to make his fillings better than he ever made them before, to save teeth that never could be saved before; enables the poorest dentist to make fillings as good as the best and to do his work in a small fraction of the time heretofore required. The Taggart patent has recently been the subject of an equity suit brought in the Supreme Court of the District of Columbia which was argued by Russell Wiles, Esq., of Chicago and Francis M. Phelps, Esq., of Washington, on behalf of the plaintiff, and by Messrs. E. T. Fenwick and L. L. Morrison of Washington, on behalf of the defendant. In this suit the Court, speaking by its Chief Justice, the Hon. Harry M. Clabaugh, rendered a decree on February 8th, 1912, finding the Letters Patent No. 872,978 good and valid in law as to each claim thereof and also issued an injunction restraining the party defendant from practising the invention. The case appears to be an important one since it will affect most of the dentists of the United States following modern methods and will, of course, through these dentists, affect the legion of patients. The census of 1900 gives the number of dentists in the United States as 29,704, and while the last census has not yet reported the number of dentists in 1910, it is fair to assume that the number has increased proportionally to the increase of population, which was about 20 per cent, so that the number of dentists in the United States to-day is probably between 35,000 and 40,000. The invention is of extreme simplicity and it is claimed in behalf of the patentee Taggart that while he was an experienced dental operator he spent twenty-five years in bringing the invention to the practical point and points out numerous reasons why this time was consumed.

I—Shall I Give My Boy a Technical Education?

By John Ritchie, Jr.

[Hardly a week passes but the Editor receives letters from readers of the SCIENTIFIC AMERICAN *who ask him whether they shall send their boys to a technical school. Assuming that the boy has a natural liking for technical subjects, and a reasonable amount of energy, there is no reason why he should not succeed in life as a technically-trained man. Whether a boy shall become an engineer or a chemist, a naval architect or a metallurgist, are questions that puzzle parents. This is the first of a series of articles intended to help them. The advantages and requirements of various technical professions will be taken up. The editor will be pleased to aid readers of the* SCIENTIFIC AMERICAN *in deciding the matter of technical education for their boys.—*EDUCATIONAL EDITOR.]

"COAL is already a relic of an age that is gone," prophesied Dr. R. C. Maclaurin, president of the Massachusetts Institute of Technology, in Chicago. "Coal is soon to be cast in the limbo where the flint and steel have been thrown."

At the time Dr. Maclaurin had half completed a great trip of three or four thousand miles through the South and West to pass the time o' day with "Tech" graduates and at the same time to observe a little the trend of modern business toward the scientific. On every side he heard the heads of great corporations, men accustomed to thinking and doing big things, tell him that technical education is the most important factor in future commercial advance—more important than coal.

One man who spoke thus was T. Coleman du Pont, president of the du Pont de Nemours Powder Company, in that rarest of phenomena with him, a speech. "Every day there is more and more need," he said, "for men trained in schools of technology in modern business. They are required not merely for the routine work of insuring uniformity in the quality of the product, but there must be trained men to meet the new problems as they rise, and solve them." Incidentally it is interesting to note that his great company spends not less than three hundred thousand dollars a year in scientific research in matters along the lines of business needs.

It was the same question of meeting new problems when the great camera and optical works at Rochester were visited by Dr. Maclaurin. At Minneapolis it was the milling of flour that was the focus of attraction to the Technology visiting party. Here a great milling firm finds that chemists are as important as factory hands—more so. The quality of the flour must be uniform, which means constant attention; the wheat from which the flour is made comes from hundreds of fields, no two of which perhaps may be sending precisely the same raw material. The older ways of trying the flour by baking batches of it have all passed away. The prime factors upon which increased business must depend, viz., excellence and uniformity, a product that is good and which may be depended upon to maintain its goodness, rely upon the tests of a large group of men trained in technical schools.

What Self-taught Edison Thinks of Technical Education.

It is interesting here to note what Edison has said with reference to the industrial future of the country and of technical education. This great master of invention, who has felt the need of specialists in his own work and has for more than thirty years been employing young men from technical schools, knew what he was talking about when he said:

"The industrial salvation of America lies in the institute of technology. What the country needs more than anything else at the present time is more technical schools, for the future of America demands technical education for its citizens."

Edison backs his opinion by sending his own son to be educated at the Boston Tech. "We want our schools and colleges to turn out the men the country demands," concluded he.

In Pittsburgh Dr. Maclaurin met the steel men, who talked earnestly of the need of technical training if the young business man is to hold his own against competition. This is evident throughout the whole industry. The changes in recent years in processes of manufacture of steel emphasize this. No one can predict in advance what may be the effect of minor factors. What was regarded a small field of operation only twenty years ago has been the means of saving to the country more than eighty million dollars in the cost of steel.

Some of these figures are astounding. For example, in the recent Congress of Technology in Boston, one speaker referred to the saving, not what might be effected, but what actually had been effected within the last decade in the lighting of this country. As a result of improvements due to scientific advances, he estimated that the light consumed in the United States to-day costs $240,000,000 a year less than it would have cost with the means employed ten years ago.

In a public address a short time ago, Dr. Maclaurin carried the idea of technical training to its logical sequence when he said: "Such achievements impress one with the possibilities of advancement. That so much can be done in what was apparently so small a field gives some evidence of the extent of the revolution that would be effected in every phase of life, in our households, our commerce, our industries and in our government, if the method and spirit of modern technical science were applied to every problem that presents itself." And this is exactly what higher technical training is doing.

Tin and Technical Education.

Again in Pittsburgh, to take up once more the line of Dr. Maclaurin's recent study, the American tin plant has not been slow to take advantage of expert investigation, and at its instance the chemical laboratory. Professor W. H. Walker attacked the problems of this business in a remarkable and telling series of researches. Such problems are given day after day to the best schools in the country, where the laboratories with a great force of efficient observers in the student body and competent supervisors in the professors make such investigations possible. At this very moment two important researches in the direct interests of business are under consideration at Boston—the efficiency, element by element, of the electric truck, and the bacterial content of eggs. These two researches alone will be financed to the amount of nearly ten thousand dollars together. That commercial houses are willing to do such things shows better than anything else the great dependence of manufacture and trade on science.

At Cincinnati, the center of the steel tool industry, the president of one of the large companies constantly calls for technical men. At Akron, again, the greatest manufacturing center of rubber in the world, there is the same call for men skilled in technical specialties, chiefly in the department of chemistry.

The Canadian Commission on Technical Education.

All this interest in business centers and realization of the need of trained men is making itself distinctly felt in educational circles. The Dominion of Canada appointed two years ago a Royal Commission on Technical Education. This included some of the best of the educational authorities in the country. It was an important commission. It had even the power of a court to summon witnesses and demand answers. This company of men has deemed the subject of technical education of sufficient importance for them to undertake long journeys into distant lands. For two years the commission has been viewing schools and getting figures of industrial needs. It is about to recommend the establishment in Canada of technical schools of the highest grade and a greater development of the "mechanic arts" schools. These furnish not only skilled labor for the minor positions, but fit men for the higher schools.

And this good opinion of technical education is by no means confined to Canada. Only within a short while has it been considered by the Maryland Legislature that Johns Hopkins University ought to have a technical school, and so a joint committee of Senate, Assembly and university visited existing technical schools.

There has probably never been brought together a more important group of specialists than that which met in Boston in April, 1911, to celebrate by a Congress of Technology the fiftieth anniversary of the establishing of the Massachusetts Institute of Technology. Of the

many papers presented, almost every one had a direct bearing on the relations of technical education to successful business. It is worth while to quote what a few of these experts had to say. "It is for these reasons," said H. E. Smith, chief chemist of the Lake Shore and Michigan Railway, "that the broad and comprehensive training offered by the Institute of Technology is especially adapted to fit men to take up scientific work for the modern railway." Willis R. Whitney, director of the General Electric Company's research laboratory of Schenectady, upheld most vigorously the thesis that research is a financial asset. He gave many concrete examples of the principle, noting that as late as 1906 there were used annually in his manufactures 30,000 drilled soapstone plates at $1.10 each. Experiments by skilled men on substitutes reduced the cost to below 30 cents each, a saving in this one item of about eighty per cent. Mr. Whitney instanced a large establishment, some of the details of which he knew, and here about $800,000 is saved each year over former costs through the agency of a chemical laboratory, the whole expense for which is only thirty-seven per cent of the saving. Tracy Lyon of the Westinghouse Electric Company said at the same congress, "Of the greatest importance to the industries of to-day is the scientific education of young men to fill their ranks." Theodore W. Robinson, of the Illinois Steel Company, expresses the opinion that "a training that is either too cultural or too specialized does not harmonize with present requirements."

From all this testimony it is very evident that business has to-day entered into a technical era, where young men trained in efficient schools are watching the processes, determining quality and economy of work and nosing out improvements through their mathematics, chemistry and other scientific attainments. The call for the future will be increasingly stronger and the field continually enlarging. The young man of to-day should fit himself with broad foundations that ought to include not only mathematics, but some literature, history, a foreign language or two, and some knowledge of the essentials of business forms, and on this build his superstructure of special attainment. Such men are needed by the commercial world.

Making Oleomargarine Respectable

(*Concluded from page 192.*)

of Animal Industry of the Department of Agriculture. It is the duty of this division to see to it that no unhealthy or impure substances reach the people through the packing houses. The animal fats that go into oleomargarine are packing house products and must therefore be carefully inspected and known to be pure before being passed. So has the government a check upon the materials that go into oleomargarine and so does it pass upon the final product before it is allowed to find its way to the market. This gives the public the government's assurance of the wholesomeness of this substitute butter.

The Bureau of Chemistry in its investigation of foods and its enforcement of the pure food law is likewise interested in oleomargarine. Dr. Harvey W. Wiley of that bureau gives this product a clean bill of health and states that its food value is very nearly the same as that of butter.

The final governmental agency that has had its fling at oleomargarine is the Committee on Agriculture of the House of Representatives. Oleomargarine occupies a very peculiar position in the eyes of the law. It is the only food product that originates in the United States that is subjected to a tax. The only other products so taxed are liquors and tobaccoes, both luxuries. All the authorities agree that oleomargarine is a perfectly good food product serving an unquestioned purpose yet singled out of all industries as the bearer of an internal revenue tax.

Oleomargarine is taxed to-day because of a bad reputation that it gained in the early history of the industry. When its manufacture was first begun it was surreptitious and the ultimate product paraded brazenly as butter. There being no supervision over this early manufacture and its being conducted by men who openly practised deception, a great antagonism for it was early created. Much of this antagonism was probably justified. It was in those early days that oleomargarine came to be known as "bull butter," "table lard," and "axle grease." All producers of *bona fide* butter naturally arrayed themselves to combat this counterfeit. It was to discourage this counterfeiting of butter that a tax was first placed on oleomargarine. This tax was two cents a pound and remained in effect until about a decade ago, when it was repealed and a new law passed in its stead.

This new law had as its purpose the prevention of the use of coloring matter in oleomargarine and therefore the prevention of its masquerading as butter. This law placed a tax of ten cents a pound on colored oleomargarine and one-fourth of one cent per pound on the uncolored. The men who framed the law expected it to result in oleomargarine reaching the market only in the uncolored form and therefore selling for what it really was. As a matter of fact the result attained was entirely different. Instead of causing the product of the factory to reach the market in its original white condition it converted the dealers of the nation into a class of men who were so sorely tempted that a large per cent of them became moonshiners.

The addition of a capsule of coloring matter to a tub of this white oleomargarine added nine and three-fourths cents in value to each pound in the tub. It did even more than this because, by practising a bit of deception, the dealer was enabled to sell this colored oleomargarine for butter at an advance of probably twenty cents a pound. The law required him to sell his oleomargarine from a tub on which the contents were plainly marked, but the tub often sat under the counter where the customer had little opportunity to note the manner of its labeling.

The method most ordinarily applied by a dealer was this: He would buy twenty tubs of oleomargarine, one tub of which was colored and had paid the ten-cent tax and the other tubs of the white product which bore the smaller tax. He would sell out of the colored tub. When it became almost empty he would administer his capsule of coloring matter to one of the other tubs and replenish the tub that bore the proper government label. So might the process be continued until all the twenty tubs had been sold out at the advanced price or as butter. If a government detective watched this man and found him actually coloring the product he might not be arrested because the law allows a man to color oleomargarine for his own use and the dealer might make this claim. It was shown to be next to impossible to bring into court evidence that would prove that a man had colored a given tub of oleomargarine and had sold that identical oleomargarine over his counter. The Internal Revenue Office informed Congress that its law was impossible of enforcement. It also told the legislative branch of the government that its law was converting the mass of the small dealers of the nation into violators of the statutes. It asked that the present law be repealed and that it be given a new statute that was enforceable.

Congress has spent two years in investigating the virtues of oleomargarine as compared with butter and attempting to determine what should be the nature of a substitute law. Representative John Lamb of Virginia is chairman of the House Committee on Agriculture which has charge of the oleomargarine investigation. Representative A. F. Lever of South Carolina is the chairman of a subcommittee which is drafting a report upon this matter. Both the committee and the sub-committee have reached the conclusion that oleomargarine is a first class food and that the American people should be given every opportunity of purchasing it upon the basis of its own merit. They are determined that it shall not be sold as butter but have no objection to its being made to resemble butter in every respect, including color. They are going to insist that the manufacturer of oleomargarine put it up in packages ranging from half a pound to five pounds and that those packages bear the government seal which must not be broken until the product reaches the ultimate consumer. Just this thing happens in the matter of all tobacco used in this country. The members of the committee believe that oleomargarine, being the product of one home industry, should not be taxed for the protection of any other competing industry. They believe that its sale as oleomargarine will be of benefit to the country as a whole and particularly to the great mass of working people to whom the high price of butter makes its use almost prohibitive. But these men are in-

declined to compromise and place a tax of one or two cents a pound on this product.

Oleomargarine was invented by a Frenchman residing in Paris in 1870. His name was Mege-Mouries and the objects of his early experiments were to produce a substitute for butter that was much cheaper and better in that it was within the reach of the masses. Mege-Mouries succeeded in making a product that was not greatly different from the oleomargarine of to-day and which was made in a similar, though, of course, much cruder way. He began with beef fat as a basis of his product and heated this with water, allowing it to cool slowly that much of the stearin and palmatin might crystallize out of it. Thus he made an oleo oil that was very similar to the oleo oil that is in use to-day. He did not use, however, the leaf lard to produce "neutral" which is largely used in oleomargarine to-day. Neither did his product contain cottonseed oil nor many of the other oils that are likely to appear as the product is now made. He did, however, churn his oleo oil in milk in order to give it the consistency and flavor of butter.

Oleomargarine found a ready market in France and throughout Europe. In those countries where the population is condensed and where the poorer classes are large and are not able to buy butter, oleomargarine found a ready sale. Its manufacture soon spread throughout Europe. It is claimed for it that many thousands of peasant children in Europe who were suffering from rickets because of a lack of animal matter in their food, soon found their physical condition greatly improved because of oleomargarine.

All the countries of Europe are now great consumers of this imitation butter. Holland has become its greatest manufacturer. There is a single factory in Rotterdam which produces as much oleomargarine as does the whole of the United States. London is a vast consumer of this Holland-made oleomargarine. It enters into the commerce of the world and is shippped to almost all the ports reached by the great trading ships. While the United States cuts little figure in the oleomargarine trade of the world, it may claim some prominence as a manufacturer of the animal oils that go into the product. Great quantities of these animal oils of the packing houses are each year shipped abroad, going very largely to Holland.

The International Congress of Navigation

THE Twelfth International Congress of Navigation will convene in Philadelphia May 23d next. Its sessions will be opened with a formal address by President Taft, head patron of the congress, followed by a reception to the delegates of foreign nations and distinguished foreign engineers who will attend.

This is the first International Navigation Congress since that in St. Petersburg in 1908, and the first to be held in America. Previous congresses have been conducted at intervals of about four years since 1885, in Belgium, Holland, England, Germany, Italy, France and Austria.

The purposes of these congresses, broadly speaking, are to further the progress of work in the interest of navigation. Their success and growing importance are evidenced by the rapid growth in membership and the respect in which their publications are held. The permanent association which conducts the congresses now includes thirty-five nations in its membership, as well as thousands of the foremost engineers and navigation authorities of the world. Its headquarters are in Brussels, and it is governed by a commission composed of delegates from the various countries holding membership.

The twelfth congress, to be held in Philadelphia, comes to America at the invitation of the United States Government, which has made an appropriation of $50,000 toward its expenses. A like amount will be given by the city of Philadelphia, and the State of Pennsylvania has granted $25,000. Appropriations will also be made probably by the city of Pittsburgh and the State of New York for the entertainment of foreign delegates on excursions to be conducted after the close of the congress in June.

Owing to the rapid increase in the number of navigation problems the congress at Philadelphia will have greater importance than any of its predecessors. This is indicated not only by the comprehensive nature of the programme and the brilliant array of expert writers who will contribute papers, but more markedly by the large attendance of foreign engineers and navigation authorities. Many hundreds will come from Europe in addition to the official delegates. South America will send a considerable delegation and others will come from Japan and Australia.

The proceedings of the congress at Philadelphia will be divided into two sections, one on inland waterways and the other on ocean navigation. Some of the important subjects to be discussed are the equipment of ports with mechanical facilities for freight handling, the most economical and profitable dimensions for large canals, the proper dimensions for ship canals such as those of Panama, Suez and the Kaiser Wilhelm Canal in Germany; the probable dimensions of ocean steamships of the future (on which depends largely the size of docks and canals planned now) the control and improvement of navigable rivers; the use of concrete for constructing sea walls, retaining walls, docks, canal locks, piers, etc., means for docking and repairing, etc.

Many of these subjects, particularly those relating to barge canals, river and harbor improvements, port facilities and means for docking and repairing vessels, are of vital importance in this country at present, and the discussions at this congress will be of great value.

Progress in each of these subjects will be reported by an authority from each of the principal countries, followed by papers and discussion of a more general nature.

Arrangements for the congress are in the hands of two organizing commissions, general and local. The general commission is composed of representatives of the United States Government on the permanent international commission. Its executive committee consists of Brigadier-General C. W. Raymond, U. S. A., retired; J. Hampton Moore, Congressman from Pennsylvania, and Lieutenant-Colonel J. C. Sanford of the U. S. Engineer Corps, who is the general secretary of the congress. The local organizing commission is headed by Congressman Moore, who is president of the Atlantic Deeper Waterways Association, and one of the most active advocates of improved waterways in this country. Other members include Mayor Blankenburg, E. T. Stotesbury and many others of Philadelphia's leading citizens. Elaborate arrangements are being made for the entertainment of visiting delegates.

After the close of the congress excursions of foreign delegates and visitors to view some of the more important navigation works in this country will be officially conducted. Some of the places to be visited will be the Cape Cod Ship Canal, New York Harbor, the New York Barge Canal, the Great Lakes, with their numerous ports and canals, Chicago, Pittsburgh, Baltimore and Washington and the Isthmus of Panama.

The Heavens in March

(*Concluded from page 198*)

when near the horizon, by about half a degree. When the Sun's center would theoretically just be rising, therefore, we actually see the whole Sun clear of the horizon by half the diameter; and the first glimpse of the Sun is seen four minutes earlier. This process reverses itself at sunset; consequently the actual day is lengthened by four minutes at each end, and the night correspondingly shortened. This may account for the fact, which puzzles some thoughtful people, that on the day of the equinox, the almanacs give the day fully a quarter of an hour longer than the night, while the day and night are of equal length three days previously.

Another question that naturally arises is, Why does the equinox fall this year on March 20th instead of the 21st? The answer to this is simple. The real interval between successive passages of the Sun through the equinox is 365 days, 5 hours, and 49 minutes; so, as everyone knows, we have to put in a leap year every four years to keep the Sun and the calendar together. In ordinary cases the Sun's equinoctial passage comes about six hours later in each calendar year than in the last; but when the 29th of February has intervened, and the calendar year is a day longer than usual, it comes about 18 hours earlier by the calendar date. This is what has happened this time. Though last year's equinox

came on the 21st, and this year's on the 20th, they are no nearer together than usual.

Princeton University Observatory.

One of the "Ten Stories"

[Many of our readers have doubtless heard of the "Ten Stories," a little book containing true narratives of scientific events in which the SCIENTIFIC AMERICAN *played a predominant part. It has been quite impossible to meet the demand for the "Ten Stories." Accordingly, they will be republished, one at a time, in these columns, for the benefit of those readers who were unable to obtain a copy of the original booklet.*—EDITOR.]

The Wise Eyes of Robin

ROBIN appeared in the office of the SCIENTIFIC AMERICAN one day and modestly requested the editor to come with him to look at a machine for making incandescent gas mantles. No, he had never worked in a mantle factory. He was a painter and paper hanger by trade. He had learned the rudiments of it in Russia before he came to this country in the steerage. From painting and paper hanging he had graduated into the show case business.

The regular course of his work as a painter had taken him to a factory where the mantles were made, and he had watched the process. The waste struck him as criminal. If the editor was willing they would go to that factory.

A "stocking" was first knit of cotton thread and then saturated with a solution of thorium. Thus impregnated, one end of the stocking was sewed up with asbestos thread, leaving a loop for handling. The cotton thread was ignited and burned away, leaving a netting composed almost entirely of oxide of thorium. Then followed the process of shaping and hardening in a Bunsen flame, after which the mantle was dipped in a coating solution to protect it from breakage in transportation.

The output of perfect mantles by each workman was a very small percentage of the number he handled. The breakage was enormous. Also many mantles shrank unequally, making them unfit for use.

The wise eyes of Robin had observed these things carefully while he was painting in the factory, and the thrifty soul of him was wrenched by what seemed such unnecessary waste. This led him to study the whole process, and as a result he had invented a machine to make mantles automatically.

It was working in another factory, and Robin led the way. It seemed a rather large, tall framework. Two operators slipped impregnated stockings into place upon carrier bars, which, by an ingenious arrangement of sprockets, were made to move, first over the set of burners by which the fabric was burnt off, then to a set of burners by which the lower part of the mantle was shaped, and finally to a series of cups containing the coating solution into which the mantles were dipped. The machine turned out four hundred and fifty perfect mantles an hour.

Robin had the device patented. He would not sell a single machine, but he would rent them for $1,500 a year each. Now the immigrant who came to America in the steerage travels between England and America in the finest cabins of the lordliest ships, to inspect his workshops here and abroad. Between times he amuses himself by giving automobiles to his relatives.

The Current Supplement

IN this week's SUPPLEMENT Dr. Zahm contributes a very valuable article on Torque in Aeroplane Propellers.—The influence of aquatic organisms, sewage and industrial waste upon the purity of natural waters is treated in a very able manner by Maximilian Marsson in an article which appears in the current issue.—A handsomely illustrated note on Spitzbergen is contributed by Dr. Gradenwitz.—The use of electric wave detectors in the service of meteorology is described by our Paris correspondent.—An important discussion from the pen of C. W. Drake of the cost of industrial electrical power and the relative advantages of group and individual motor drive is reproduced from the Proceedings of the Engineers' Society of Western Pennsylvania

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Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12608) C. L. W. asks: An interesting proposition has arisen at the club where the writer dines as to the distance that a band around the earth would extend from the surface all the way around by the insertion of six inches to an imaginary band around the earth at its greatest circumference, say 25,000 miles. Some of the members contend that it would extend an inch from the surface at all points by lengthening the band six inches, while others think that it would be so slight as to be infinitesimal. If you could furnish the writer with a correct answer, he would feel greatly obliged. A. The increase of the diameter of a circle by an increase of the circumference is determined as follows: Let C be the circumference and D the diameter of a circle, and let the circumference be increased by a quantity a, then let the resulting increase of the diameter be represented by x. The result will be $C + a = (D + x)\pi$. By clearing of fractions, we have $C + a = \pi D + \pi x$. But πD is the circumference, hence we have $x = \frac{a}{\pi}$. The increase of the diameter by increasing the circumference by 6 inches is $6 \div 3.1416$, which is a little less than 2 inches. The band would be raised about one inch from the surface of the earth, as some of your members contend.

(12609) R. C. J. writes: We have every reason to believe that the temperature of the outer portion of the earth's atmosphere is nearly absolute zero. This outer portion of the atmosphere must be in a liquid state. Liquid air occupies much less space than air at the ordinary temperature; therefore, as the outer portion of the atmosphere is liquefied, it is precipitated toward the earth the same as rain, except that it is not allowed to remain a liquid because of the heat which is absorbed from the warmer air near the earth. So far as I can see, there is no foundation to the theory that the earth's atmosphere is evaporating into space. A. We are not able to follow your reasoning by which you conclude that the air at the upper limit of the atmosphere is in the liquid state. Mere cooling will not liquefy a gas. Cooling and pressure are both necessary for liquefaction of a gas. And with the pressure almost or quite at zero, it is not probable that liquefaction would be possible. Many comets, as is shown by the spectroscope, are gaseous, as they move through the same spaces as the earth, and are not so thin as the air at its upper limit. Then, too, why should not the heat which is radiated from the earth prevent liquefaction, since it is sufficient, as you assume, at a little lower level to vaporize the liquid air again? We do not know any foundation for a theory that "the atmosphere is evaporating into space." The lighter gases, which are found as mere traces at present, are believed by some to have been more abundant in a remote past and to have escaped in the form of gases from the atmosphere by reason of their kinetic energy. There is no theory, so far as we know, held by anyone that these gases were ever liquids and then evaporated into space as gases.

(12610) E. G. asks: Does water freeze from the top and continue down, or does it freeze on the top continually? A. Water freezes over first at the top, and then the ice forms on the under side of this layer, so that the ice thickens from the under side. No water can pass through ice to freeze on the top. Ice is not porous, as anyone can prove by making a dish of ice and filling it with water. The water will not leak out through the ice dish. Ice forms several feet thick in a long winter in northern regions. The water in contact with ice is at the temperature of the freezing point of water, and is lighter than the water below it, which is at 39 deg. Fahr. or 7 degrees above the freezing point of water.

(12611) "A Reader" says: "Kindly let me know in your columns a safe way to have a small article patented with the least expense?" If "A Reader" will send us his name and address, we will be very glad to send him our Patent Hand Book and full information. It is not possible for us to answer letters which are not signed with the full name and address.

(12612) C. M. K. asks: Would you kindly send me a receipt for mixing some preparation to be coated over electric lights in order to obtain different colored lights? A. The dips for coloring electric light bulbs are generally a hard-drying varnish colored with an aniline dye—red, gold, or blue. There are various modes of preparation given in our "Cyclopedia of Receipts," under the caption, "Electric Light Bulbs, Coloring," on page 526. We will send the book for $5.